Government of Tamil Nadu
State Planning Commission

cenex

British Deputy High Commission Chennai

UK PACT

REPORT

2023 - 2024

Low Emission Zoning

A Toolkit for Chennai

Low Emission Zoning

A Toolkit for Chennai

Part I
UK Lessons Learnt and Best Practice

&

Part II
Roadmap for
Implementation in Chennai

Government of Tamil Nadu
State Planning Commission

This toolkit for Low Emission Zoning in Chennai has been crafted with the support of UK PACT Program by CENEX.

2023 - 2024

Collaborators

State Planning Commission
Government of Tamil Nadu

—

British Deputy High Commission, Chennai

—

CENEX
Centre of Excellence for Low Carbon and Fuel Cell Technologies, UK

UK PACT Program
UK Partnering for Accelerated Climate Transitions

Acknowledgements

We express our gratitude to the British Deputy High Commission for their invaluable contributions in collaborating with the State Planning Commission, for the development of the **'Low Emission Zoning: A Toolkit for Chennai'** by pooling our collective expertise and resources in formulating a comprehensive plan for Chennai.

We would like to acknowledge the crucial role of UK Partnering for Accelerated Climate Transitions (**UK PACT**) programme and **CENEX**, a UK-based not-for-profit organisation specialising in decarbonising transport and energy systems, especially Thiru. Steve Carroll, Head of Transport at CENEX, in developing this toolkit for implementing Low Emission Zones (LEZ) based on the learnings from the UK.

We sincerely thank the team from **British Deputy High Commission, Chennai** - Thiru. Oliver Ballhatchet, British Deputy High Commissioner & Deputy Director - Investment, Thiru. Sam Prasanth Kumar, Senior Advisor and Tmt. Tabinda Bashir, Advisor, British Deputy High Commission, Chennai for their support in taking up this project and its successful completion.

We are obliged to the Members of the **State Planning Commission** for their valuable guidance and direction throughout the project. We express our sincere appreciation to Tmt. S. Sudha, IFS., Member Secretary of the State Planning Commission and the team at the State Planning Commission, for wholeheartedly guiding the team towards achieving the successful completion of this project.

Additionally, we commend the dedicated involvement of the stakeholder departments for sharing their suggestions and data and their participation in the series of meetings and workshop in the development of this tool kit.

Executive Summary

Tamil Nadu's State Planning Commission in collaboration with the British Deputy High Commission at Chennai through the UK PACT programme has come out with a report on 'Low Emission Zoning – A Toolkit for Chennai,' which was crafted by CENEX, UK.

The report comprises of two integral components: 'UK Lessons Learnt and Best Practice' and a tailored 'Roadmap for Implementation in Chennai'

The first segment meticulously extracts insights from the UK experience. It elucidates the toolkit's background and objectives, offering a profound introduction to Low Emission Zones within the context of UK policies, national legislation, and case studies. Strategic considerations, including intervention rationale, air quality monitoring, and the impact of low traffic neighbourhoods form its foundation. Critical aspects like vehicle types, emissions standards, and spatial coverage are thoroughly explored.

Subsequent sections delve into the nuances of low emission zoning implementation. Legal frameworks, vehicle standards, future-proofing strategies, operational specifics, exemptions, discounts, and charge levels are examined.

The report emphasizes citizen engagement and outreach to local businesses, weaving a fabric of community involvement. The report justifies and assesses the impacts of implementing Low Emission Zones in the era of rapid urbanization and sustainable development. It meticulously analyses the benefits, costs, and constructs a compelling business case. The report distils collective wisdom from the UK experience, laying the groundwork for the "Roadmap for Implementation in Chennai." This roadmap strategically navigates essential components, encapsulating economic and policy contexts in India, delineating Chennai's unique characteristics, and emphasizing the pivotal role of citizen engagement.

The toolkit and roadmap together form a robust framework for Chennai's sustainable urban development, reflecting the collaborative efforts of State Planning Commission and the British Deputy High Commission. This comprehensive guide, tailored to Chennai's needs, poised to usher in a new era of low-emission urban zones, aligns seamlessly with global sustainability goals.

Part I

UK Lessons Learnt and Best Practice

Table of Contents

1. Introduction 4
1.1 Background 4
1.2 Toolkit development and objectives 5
1.3 Toolkit contents 6
1.4 Introduction to Low Emission Zones 7
1.5 UK Policy Context 8
1.6 UK National Legislation, Strategy, and Guidance 10
1.7 Overview of UK case studies 12
2. Setting a Strategy 15
2.1 Introduction 15
2.2 Rationale for Intervention 15
2.3 Air Quality Monitoring 17
2.4 Low Traffic Neighbourhoods 19
2.5 Vehicle types and emissions standards 22
2.6 Spatial coverage 24
2.7 Supporting local growth and ambition 26
2.8 Accelerating transition to a zero emission society 28
2.9 Associated actions to improve air quality 30
3. Adding the Detail 32
3.1 Introduction 32
3.2 Legal 32
3.3 Vehicle standards 34
3.4 Future proofing 35
3.5 Vehicle detection 36
3.6 Hours of operation 39
3.7 Exemptions and discounts 40
3.8 Levels of charge 42
3.9 Payments and fines 44
3.10 Engaging citizens 46
3.11 LEZ Website 48
3.12 Engaging businesses 49
3.13 Timescales 51

4. Justification and Impact Assessments 52

4.1 Introduction 52
4.2 Overview and guidance 52
4.3 Benefits 54
4.4 Costs 56
4.5 Business case 59
4.6 Impacts on businesses 60
4.7 Impacts on citizens 61
4.8 Vehicle replacement scheme 63

5. Conclusion 65

1. Introduction

1.1 Background

Several states and cities in India have committed to measures that lower transport emissions, including trialling low emission zones. However, there are no clear guidelines that outline best practice for achieving low emission zones which states and cities can then tailor to their own contexts.

The UK has responded to challenges around urban air quality by introducing zones in several cities which aim to reduce the use of older more polluting vehicles. This includes London's Low Emission Zone (LEZ) and Ultra Low Emission Zone (ULEZ), Oxford's Zero Emission Zone (ZEZ), and Clean Air Zones (CAZ) in several other cities. The UK government has set a framework for zone design, within which cities can set their own parameters.

As a leader in the deployment of air quality improvement zones, learnings from UK cities' experience can be used to develop best practice guidance for other countries. This can help other jurisdictions develop and deploy their own air quality improvement zones.

1.2 Toolkit development and objectives

This toolkit has been commissioned by the UK government via the UK Partnering for Accelerated Climate Transitions (UK PACT) programme. It has been developed by Cenex, a UK-based not-for-profit specialising in decarbonising transport and energy systems.

This toolkit has been developed alongside a training programme, delivered to selected cities in October 2023. The overarching aim of the toolkit and training programme is to provide capacity building support, based on best practice guidelines, to Indian cities and states to reduce pollution caused by tail pipe emissions and help them contribute to India's net zero Target.

The objectives of this toolkit are to:

- Share learnings and best practice from the implementation of low emission zones by cities in the UK.
- Provide strategic guidance to beneficiary cities in India on the creation of inclusive low emission zones to enhance local air quality and contribute to net zero goals.

The toolkit and training is intended to be used initially by city and state authorities in Chandigarh, Chennai, Kolkata, and Pimpri Chinchwad. The toolkit has been designed to be applicable to other states and cities and therefore could be disseminated more widely in the future. As such it is not a prescriptive guide to designing low emission zones. The guidance provided here should be used in conjunction with an understanding of the local context, and city-level data, to design appropriate and inclusive low emission zones.

Cenex developed the content for this toolkit by undertaking the following tasks:

- **Reviewing published reports** on low emission zone implementation in the UK, including feasibility studies and business case assessments.
- **Interviewing representatives of cities** which have implemented low emission zones or similar schemes.

1.3 Toolkit contents

This toolkit is in two parts. **Part 1** (this document) is lessons learned and best practice from the UK and **Part 2** is a guide for implementation in four Indian cities.

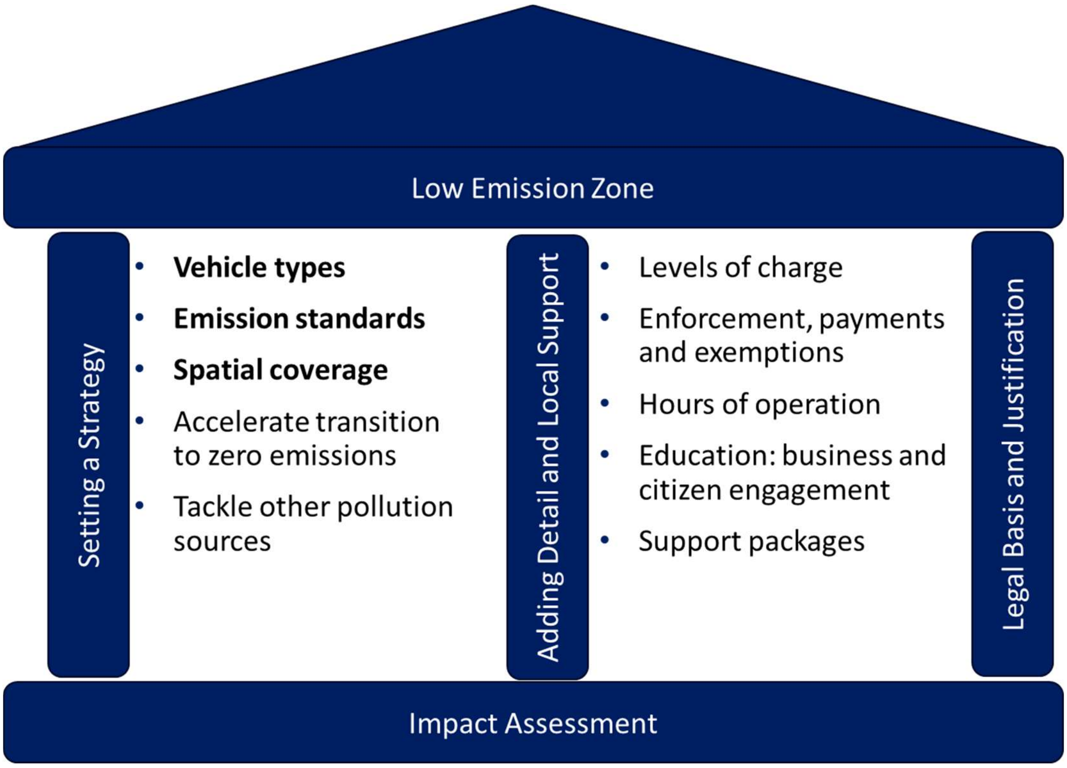
Part 1: UK Lessons Learned and Best Practice includes:

- Introduction including an overview of different types of zones and the UK's policy context.
- Strategy for LEZs: rationale for intervention and high level zone parameters.
- Adding the detail: in-depth operational and design guidance.
- Justification and impact assessments: evaluating how LEZs affect citizens and businesses.

Part 2: Implementation for Indian cities includes:

- Indian national policy context on emissions reduction.
- Introduction to beneficiary cities.
- Planning and Design: summary of best practice guidance tailored from the UK's experience.
- Citizen Engagement: how to secure support for a LEZ.
- City Action Plans to support the development of a LEZ strategy.

The contents of Part 1 are displayed in the schematic below.



1.4 Introduction to Low Emission Zones

This project provides guidance on the introduction of low emission zones (LEZ). In the UK, cities have introduced various schemes: low emission zones (LEZ), clean air zones (CAZ), ultra low emission zones (ULEZ), and a zero emissions zone (ZEZ). These broadly fall into two categories:

- **CAZ, LEZ, ULEZ**: these levy a charge on drivers of the oldest most polluting vehicles. Low emission petrol and diesel vehicles can be driven in the zone without paying a charge.
- **ZEZ**: free access is limited to zero tailpipe emission vehicles, such as electric vehicles. All combustion engine vehicles including hybrids are subject to a daily charge.

For simplicity in this toolkit we refer to all emissions control zones which allow some combustion engine vehicles in as LEZ. This should be taken to include CAZ and ULEZ, unless specified. We use ZEZ to refer to zones which do not allow combustion engine vehicles to enter without paying a charge.

In the UK, **LEZs are designed to improve air quality**. LEZs aim to reduce the public's exposure to all sources of air pollution, including nitrogen dioxide and particulates. Charges are levied on vehicles which do not meet specific tailpipe pollutant emissions standards. LEZs are not designed primarily to reduce greenhouse gas emissions which contribute to climate change. ZEZs tackle air quality and climate change by reducing use of vehicles with any tailpipe emissions. Biofuels are generally not in scope of LEZ design or ZEZs as they do not reduce pollutant emissions when compared to their fossil fuel equivalents and do not deliver zero tailpipe greenhouse gas emissions.

LEZ are not the only measure which could improve air quality. Local authorities in the UK are required by central government to "develop innovative local plans that will achieve statutory nitrogen dioxide (NO2) limit values within the shortest possible time". However, the UK government advises that LEZs with a charge for non-compliant vehicles will achieve statutory limit values in the shortest possible time.

1.5 UK Policy Context

This section outlines the national policy context in the UK within which cities designed and implemented LEZ. First, it describes the 'triple challenges' of air pollution, climate change, and traffic congestion which cities are aiming to tackle. Next, it defines the relative roles of national government and cities in the UK, including a summary of the legislation and guidance provided to cities by central government.

Introduction to air quality and climate change emissions

In the UK, LEZs have been introduced to tackle the 'triple challenges' of air pollution, climate change, and traffic congestion. Each of these is discussed below.

Air pollution

The two pollutants of the greatest concern in relation to road transport in the UK are nitrogen dioxide (NO_2) and particulate matter (PM). **Poor air quality is the biggest environmental risk to the health of many residents of urban areas, particularly the most vulnerable.** Air pollution has more severe effects on vulnerable groups including the elderly, children and people suffering from pre-existing health conditions such as respiratory and cardiovascular conditions.

The World Health Organization (WHO) guidelines were tightened in September 2021 so that there are now lower thresholds for recommended levels of pollutants. The legal limit for PM2.5 is 25µg/m^3. For NO2, the new WHO interim target is 30µg/m^3.

In urban areas in the UK, the greatest air quality challenge is concentration levels of NO_2 due to pollution from road transport. LEZs deliver air quality benefits by encouraging individuals and businesses to switch to cleaner vehicles or use more sustainable transport modes, thereby reducing the number of older, more polluting vehicles in urban areas.

Climate change

Global warming is forecast to exceed 2˚ C by 2100 unless there are deep and rapid reductions in greenhouse gas emissions, according to the UN's Intergovernmental Panel on Climate Change (IPCC). In February 2022, the IPCC warned that global warming would increase climate hazards and present multiple risks to ecosystems and humans, with the most vulnerable the most at risk.

The UK has set a legally binding target to reach net zero emissions by 2050. In October 2021, the UK Government published a net zero strategy setting out how it plans to meet that target. The strategy and the accompanying transport decarbonisation plan (published in July 2021) show that transport must be fully decarbonised to reach the net zero target.

Although LEZs do not directly aim to tackle climate change, if people switch from cars to more sustainable modes such as cycling or public transport, there will be an associated reduction in greenhouse gas emissions.

Traffic congestion

Traffic congestion is a growing concern in most urban areas. Congestion increases journey times, reduces journey reliability, and increases air pollution and carbon emissions.

Although LEZs do not directly aim to tackle congestion, if people switch from cars to more sustainable modes such as cycling or public transport, there will also be an associated reduction in total vehicle kilometres.

Tackling each challenge is complex and cannot be comprehensively addressed by any one measure. Measures should ideally tackle more than one challenge; at a minimum, progress in one area cannot come at the cost of worsening the situation on another. Reducing traffic is key to addressing each element.

1.6 UK National Legislation, Strategy, and Guidance

In the UK, at the national level, the two key documents setting the direction for cities to improve air quality are the *Air Quality Plan (AQP) for Nitrogen Dioxide* (2017) and the *Clean Air Strategy* (2019).

Air Quality Plan for Nitrogen Dioxide (NO2 Plan) (2017)

This document is the UK's national plan for bringing NO_2 concentrations within statutory limits in the shortest possible time. It summarises the impacts and sources of air pollution, defines the preferred solution (reducing road transport emissions), and outlines the government's existing and proposed future actions to reduce emissions. Crucially, it defines roles and responsibilities for reducing air pollution, covering stakeholders including national government, local authorities, businesses, the public, and others. The plan is clear that the national government's view is that poor air quality is a local issue and should action to improve it should therefore be delivered primarily by cities.

The Plan requires cities to implement measures to achieve statutory NO_2 limit values within the shortest possible time. As discussed above, the recommendation is this is in the form of LEZs. Cities are required to introduce a LEZ, or show how other measures can achieve the same benefits in the same time frame.

Clean Air Strategy (2019)

The Clean Air Strategy builds on the NO_2 Plan by setting out in more detail the case for action to improve air quality. The Strategy also:

- **Details new local powers enabled by government** to allow cities to create LEZs to reduce pollution.
- **Shifts the focus towards prevention**, promoting greater action to avoid exceedances, rather than tackling air pollution only when limits are surpassed.
- **Reports on progress made** and states additional actions needed to reduce emissions from transport.

National LEZ guidance

The government also published several documents providing the principles for the implementation and operation of LEZs in England. Cities can use this framework to design their own LEZs. **The guidance was backed up by a £275 million Implementation Fund for local authorities to take action to improve air quality, and a £220 million Clean Air Fund** to help cities mitigate the impact of their plans on individuals and businesses.

UK government support for LEZ implementation includes £275 million for measures to improve air quality and £220 million to mitigate the impact of these measures on individuals and businesses.

The UK government has also acted as a central source of information for businesses and the public about LEZ. It manages a web page with information telling you where you'll find clean air zones, how to check if you'll need to pay a charge and create a business account, and what support or exemptions are available. This is helpful for individuals and businesses which are likely to drive regularly into more than one LEZ.

1.7 Overview of UK case studies

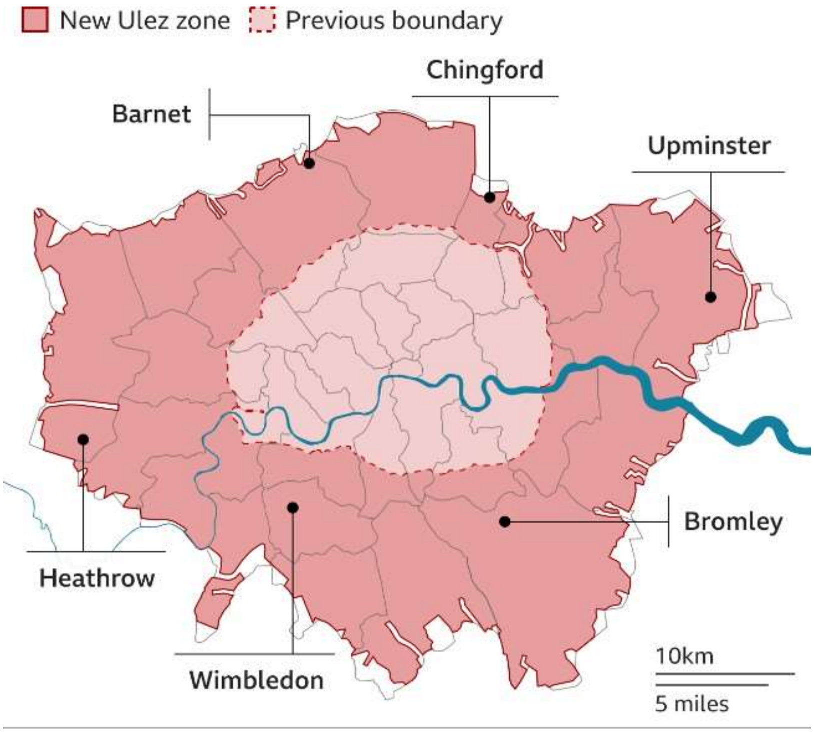
This section introduces the three cities we have taken learnings and best practice from (via desktop research and interviews) to inform the development of this toolkit. These are London's ULEZ and Bristol's CAZ (essentially both LEZs with similar standards), and Oxford's ZEZ. The case study cities are introduced below and referred to throughout the remainder of this guide.

London

London is the UK's capital with a population of nearly 9 million. It is located on a river estuary close to the sea. While the centre of London is flat, there are hills in the north and south of the city which contribute to trapping air pollution over the city. Urban canyons in the city also contribute to high concentrations of pollution.

The ULEZ was first **launched in April 2019**, with spatial coverage limited to inner London. The zone was **expanded to a wider central London area in Octoer 2021**, and **expanded again in August 2023** to cover all London boroughs. Although London had more discretion than other cities to set its own standards, the ULEZ is broadly in line with other LEZs in the UK. Diesel vehicles of all types must meet the most stringent European tailpipe pollution emissions standards (Euro 6/VI). Petrol vehicles need to meet Euro 4 standards. Vehicles which don't meet these standards must pay a daily charge to enter the zone. Charges apply 24 hours a day, midnight to midnight, every day except Christmas.

London's ULEZ is shown in the map below.



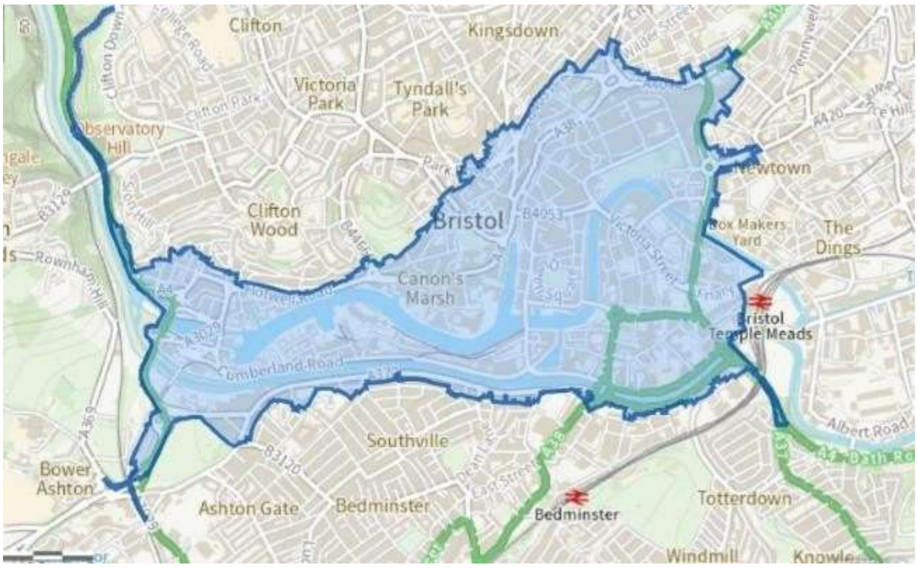
The ULEZ in central London was implemented in April 2019, expanded to inner London in October 2021, and expanded London-wide in 2023.

Bristol

Bristol is a port city in the southwest of England with a population just under 0.5 million. It has several major roads which funnel traffic towards the city centre. The city is in a valley and has narrow roads and high buildings. These factors combined to mean Bristol had some of the worst air pollution concentrations in the UK.

Bristol's Clean Air Zone launched in November 2022, covering approximately a 4 square kilometre area of the city centre. Like London's ULEZ, it encompasses buses, coaches, HGVs, vans, minibuses, taxis, and private cars. Vehicles which don't meet Euro 6/VI for diesel and Euro 4 for petrol must pay a daily charge to enter the zone. Charges apply 24 hours a day, midnight to midnight, 365 days of the year.

Bristol's CAZ is shown in the map below.

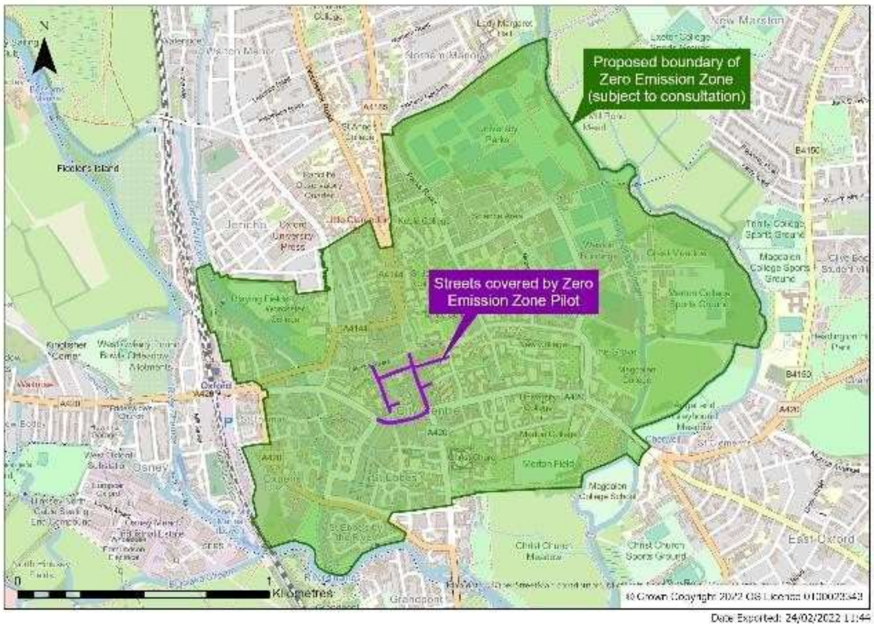


Oxford

Oxford is a small inland city in the south of England with a population of just over 150,000.

Oxford is the first city in the UK to launch a ZEZ. The scheme started as a pilot in February 2022, covering a small area of the city centre (around 1.6 square kilometres). In contrast to the ULEZ or other LEZ schemes, Oxford's ZEZ only allows zero emission tailpipe vehicles to be used without incurring a charge. If the pilot is successful, the local authority will introduce a larger ZEZ covering most of Oxford city centre in the future. Unlike the London or Bristol schemes, the ZEZ pilot will only operate from 7am - 7pm.

Oxford's ZEZ is shown in the map below.



2. Setting a Strategy

2.1 Introduction

This section sets out the strategic elements that authorities will need to consider when designing a LEZ. This covers the rationale for intervention, selecting appropriate emissions standards, deciding on spatial coverage for the zone, considerations for how a LEZ can help accelerate the transition to a low emission economy, and associated actions which could be taken to improve air quality and health.

2.2 Rationale for Intervention

Air pollution causes damage to public health, the natural environment and economic output. Evidence of the social costs of air pollution has increased with the identification of a robust direct link between nitrogen dioxide (NO_2) and mortality.

In the UK, the government estimated that the combined impact of exposure to NO_2 and PM2.5 results in up to 50,000 deaths annually, with an annual social cost of up to £27.5 billion.

Poor air quality is a negative externality, which means that the costs of pollution in deaths and other health impacts are not reflected in the public's decision-making, for example either when purchasing or using a vehicle. Government intervention is therefore needed to implement measures to reduce the causes of poor air quality. The most cost effective and efficient way to reduce road transport emissions in the UK was to implement LEZs.

A LEZ is an area in which more use of more polluting vehicles are restricted using vehicle emission standards and charges levied on non-compliant vehicles. By applying a cost to polluting vehicles, the damage costs associated with emissions become a factor in individuals' and businesses' purchasing decisions. These geographically delineated areas can also be the focus of other actions and resources to improve air quality.

Measures to tackle air pollution should be implemented at local or city level, rather than national level. Primarily this is because exposure to pollution is greater in urban areas and therefore residents of urban areas will be disproportionately impacted. In addition, pollution levels are determined by local factors including background emissions levels and weather conditions. A national control may not be effective in accounting for such local conditions.

UK cities could implement other measures to improve air quality if they were suitably effective. Bristol considered options including funding for low emission buses and cycling infrastructure. Ultimately their modelling showed that a charge-based LEZ was the most effective way of tackling pollution.

The primary objective of a LEZ should be to bring down ambient pollution concentrations to improve public health and deliver compliance with legal limit values. Zones should focus on removing the oldest most polluting vehicles from areas where pollution is worst and the risk to public health is most significant. In the UK, LEZs were designed primarily to control levels of NO_2, as cities are generally compliant with limit levels of other exhaust pollutants. In India, LEZs may also need to control levels of particulate matter (PM).

Key takeaways:

- **Poor air quality has negative health impacts which can be monetised to estimate the social damage being done.**
- **Implementing a LEZ is usually the most cost effective and efficient way to reduce emissions from the most polluting vehicles in areas of high population density.**
- **A LEZ is an area in which more use of more polluting vehicles are restricted using vehicle emission standards and charges levied on non-compliant vehicles.**
- **The primary objective of a LEZ should be to bring down ambient pollution concentrations to improve public health and deliver compliance with legal limit values.**

2.3 Air Quality Monitoring

Air quality monitoring is essential to provide the supporting evidence for the introduction of a LEZ, and for setting key parameters such as spatial boundary and vehicle types in scope. There are broadly three types of monitoring that can be used.

Automatic Monitoring

Automatic monitoring stations typically produce hourly measurements for real-time viewing. Automatic monitors draw in ambient air and measure the concentration of the pollutant in the sampled air. Software should calibrate data regularly to ensure it is accurate and reliable.

Passive Monitoring (Diffusion Tubes)

Diffusion tubes absorb pollutants – primarily nitrogen dioxide – from ambient air. Samples are transported to certified laboratories for analysis. They are used to indicate average pollutant concentrations, and therefore are useful for assessment against long term (annual mean) objectives at each location.

Air Quality Sensors

Air quality sensors tend to be simple, small and low power devices which provide high resolution data (typically one minute average or less). As with automatic monitoring, software may be needed for quality control to ensure the accuracy of the sensors. In the UK, sensors have not been certified as a reference method for compliance measurements.

The benefits and drawbacks of each option are summarised in the table below.

Monitoring type	Benefits	Drawbacks
Automatic monitoring	High data resolution Real-time reporting Identification of short-term trends	Expensive to set up and operate, including maintenance. Stations can be large.
Passive monitoring	Low cost Can work off-grid Identification of pollution hotspots	Does not provide short-term data. Requires laboratory analysis.
Sensors	Low cost High time resolution	Data must be verified against other collection methods.

Air Quality Modelling

Air quality monitoring shows where air quality is poor, but does not provide enough insight into source apportionment. Modelling is likely to be required to show the city-wide impact of different emissions sources to pollution. This could include road transport, construction, and other sources

of exhaust emissions. Modelling should combine information on tailpipe emissions, the number of vehicles or assets in the city, and their duty cycles, to estimate relative contributions. In the UK, this is compiled at a national level into the National Atmospheric Emissions Inventory (NAEI)[1].

Key takeaways:

- **Air quality monitoring should be undertaken to determine pollution hotspots.**
- **The three main options for monitoring are automatic monitoring, passive monitoring, and sensors.**
- **Modelling should also be undertaken to determine source apportionment.**

[1] About the website - NAEI, UK (beis.gov.uk)

2.4 Low Traffic Neighbourhoods

If a city can't commit to introducing a LEZ, or a LEZ is not required to improve air quality, a low traffic neighbourhood (LTN) could be introduced as a lighter-touch measure to mitigate the negative impacts of road transport.

Overview and Aims of LTNs

LTNs are generally implemented in residential areas. They seek to reduce traffic volumes by limiting use of residential roads for vehicles passing through to reach another area, while still allowing access for citizens and local businesses. Ultimately an LTN aims to reduce air and noise pollution and improve road safety. LTNs also typically include public realm improvements, encouraging people to spend time in the area.

LTNs should be prioritised in areas where they will have the greatest positive impacts. Criteria for site selection could include through-traffic volumes, pollution concentrations, high levels of deprivation, access to green space, frequency of road accidents, car ownership levels, and proximity to schools.

Benefits of LTNs

By reducing traffic levels, roads become more attractive for active travel, and public transport journeys are quicker and more reliable. Research by UK sustainable transport charity 'Sustrans' found that LTNs:

- Increase physical activity through more walking and cycling.
- Benefit local businesses through an increase in sales and higher spend per person.
- Create new public spaces, increasing social interactions between neighbours and strengthening communities.
- Help improve air quality.

A survey by Sustrans of 345 residents from LTNs in London found that:

- **63% agreed or strongly agreed that it has improved their lives.**
- **Only 14% said it has not improved their lives.**

Compared to implementing a LEZ, LTNs have the following outcomes and characteristics:

- **Limited impacts**, both positive (reducing pollution) and negative (costs for drivers to comply with standards).

- **Easier to set up and administer** with fewer requirements for hardware and back office systems.
- Driven by **education programmes** and **introduces local strategies**.

LTN Designs and Features

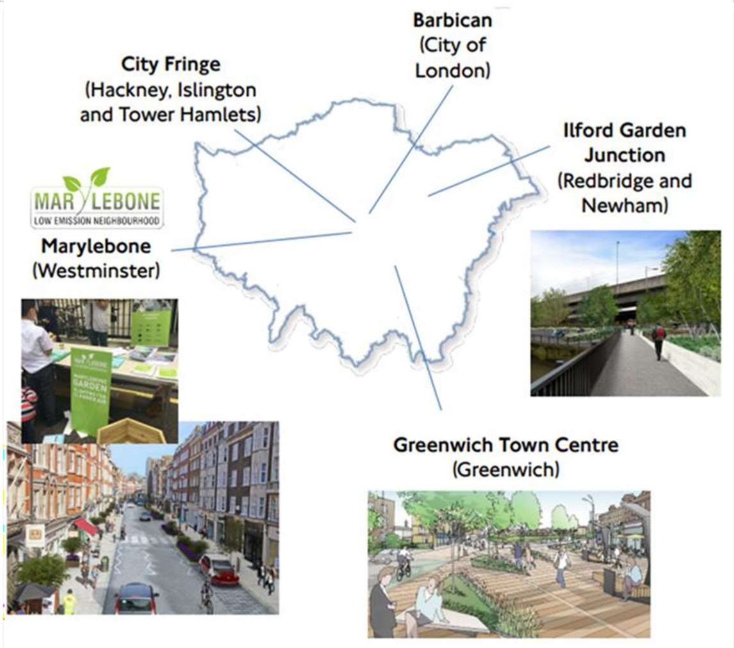
In the UK, LTNs typically comprise multiple design features from the list below:

- **Modal filters**: a bollard or planter that stops motor vehicles accessing a particular street.
- **Pocket parks**: a pair of filters which block off an area that cannot be accessed by motor traffic, but which can be accessed by bicycles and scooters.
- **Bus gates**: a modal filter which permits buses and emergency vehicles to travel through, but restricts passage of privately owned vehicles.
- **Banned turns**: Restrictions on turning at selected junctions to encourage drivers to avoid the LTN.
- **One-way streets**: Streets that only allow traffic in one direction.

In addition, LTNS may be implemented alongside measures such as:

- **Co-ordinated deliveries** to reduce freight movements at certain times of day.
- **Car-free days,** often on Sundays.
- **No idling zones** where vehicle idling is prevented through enforcement.
- **Support for EV uptake** such as access to chargepoints.

LTNs in London



Transport for London is working with the Mayor’s office and the London boroughs to pilot four LTNs.

The total budget is £13 million, funded in part by revenues from the ULEZ, as well as contributions by boroughs and the private sector.

The LTNs are shown in the map on the left.

Key takeaways:

- **A low** traffic neighbourhood (LTN) could be introduced as a lighter-touch measure to mitigate the negative impacts of road transport, if a LEZ is not feasible or appropriate.
- LTNs make roads more attractive for active travel, and improve public transport journey time and reliability.
- LTNs typically include modal filters, pocket parks, bus gates, banned turns, turning restrictions, and/or one-way streets.

2.5 Vehicle types and emissions standards

LEZs improve air quality by restricting access to certain vehicles in the fleet. A critical aspect of LEZ design is therefore to **set appropriate emissions standards for the zone**. Vehicles which comply with these standards can be allowed to drive in the zone without paying a charge. Non-compliant vehicles must pay a daily charge to enter the zone.

The purpose of linking financial charges to emission standards is to encourage individuals and businesses to transition away from the most polluting vehicles into cleaner alternatives. Modelling undertaken in the UK found that this approach targets improvements on the areas with the highest public exposure and hence greatest impact on health.

In the UK, LEZs were intended to be highly effective by including many vehicle types and use ambitious emissions standards. The UK government defined four classes of LEZ that cities could implement. These are shown in the table below, including the vehicle types in scope and emissions standards for entering the zone without paying a charge. Note that Euro 6 emissions standards are similar to Bharat Stage 6 limits.

Class	Vehicle Types	Emissions Standards
Class A	Buses, coaches	Euro VI
	Taxis, private hire	Euro 6 diesel, Euro 4 petrol
Class B	Buses, coaches, HGVs	Euro VI
	Taxis, private hire	Euro 6 diesel, Euro 4 petrol
Class C	Buses, coaches, HGVs	Euro VI
	Vans, minibuses, taxis, private hire	Euro 6 diesel, Euro 4 petrol
Class D	Buses, coaches, HGVs	Euro VI
	Vans, minibuses, taxis, private hire	Euro 6 diesel, Euro 4 petrol
	Private cars	Euro 6 diesel, Euro 4 petrol
	Powered 2-wheelers	Euro 3

Municipal authorities should aim to deliver the best possible outcomes when designing LEZs. This means **the default position should be to design ambitious schemes that reflect the best environmental performance**, rather than setting minimum emission standards. These standards should be regularly reviewed and updated to ensure they remain ambitious and reflect technology progress. This is discussed further in the 'Future-Proofing' section.

The table above shows that all vehicles on the road can be brought into scope of a LEZ. However, there are some vehicle types which the municipality can have additional direct or indirect control

over. Examples include bus fleets operated by the city, or taxis with vehicle specifications set by the authority. Cities should use the powers available to them to mandate or encourage faster rates of compliance with LEZ standards for these vehicle types.

Key takeaways:

- **Set appropriate emissions standards for the zone.**
- **Non-compliant vehicles must pay a daily charge to enter.**
- **Cities should mandate or encourage faster rates of compliance with LEZ standards for vehicle types they control or influence.**

2.6 Spatial coverage

A second critical element of LEZ design is to identify the area of the city that will be in scope. **Spatial coverage of the proposed zone should be determined by evidence from air quality modelling**, drawing on local traffic and air quality concentration models. The objective should be to encompass those areas in which concentrations are highest, and the risk to public health is most significant.

Cities should undertake an options appraisal in which more than one possible area is considered. Modelling should estimate the likely impacts of each option to understand its potential impact.

Factors to consider in modelling include:

- **Total vehicle activity** (measured in vehicle-kilometres per day).
- **Related emissions of NOx** (kg per year).
- **Dispersion modelling** to characterise the atmospheric processes that disperse a pollutant emitted by a source, including representation of canyons (primarily buildings), gradients and flyovers.
- **Meteorological data** and background concentration data.

The area could be small, as in the case of Oxford, which is piloting its ZEZ on just a few roads in the city centre. London has taken a phased approach, steadily increasing the size of the ULEZ from inner London (in 2019) to Greater London (in 2023).

An alternative to a phased approach could be to introduce two zones covering different areas (such as inner and outer city) with different emissions standards. However, UK cities that considered this and concluded that it would be complex for people to understand make it challenging to secure citizen buy-in.

All road types can be brought in scope if they exceed air quality limit values, irrespective of whether they are local residential routes or major thoroughfares. Modelling also needs to look at potential displacement routes which may be affected if non-compliant vehicles take alternative routes to complete their journeys. Some displacement is acceptable if it doesn't push an area from low to high pollution.

Ideally, a LEZ would have a natural boundary such as a city ring road, as this is the easiest for people to understand. However, some zones in the UK have irregular boundaries to capture roads or locations with particularly poor air quality. **Data from monitoring stations should be used to define the scheme boundary.** A balance should be struck between providing alternative routes to avoid the zone, while encouraging compliance as the primary response to the zone. This will also help improve air quality in areas outside the LEZ.

In the UK, modelling of spatial coverage has not typically accounted for land use zoning, such as industrial, commercial, or residential areas. Similarly, income levels are not typically considered in detail at this stage. Instead, this is modelled later to understand and mitigate potential negative impacts on low income households.

Key takeaways:

- **Spatial coverage is a critical design element of LEZs.**
- **Cities should model multiple options to understand potential impacts.**
- **A balance should be struck between providing alternative routes to avoid the zone, while encouraging compliance as the primary response to the zone.**

2.7 Supporting local growth and ambition

LEZs should be designed so that they support local plans for economic growth. They should be a positive attractive asset for a city, and for the businesses based there. Offering a business environment in a city with clean air could help to attract new investment.

As such, LEZ design should not sit separately from other aspects of city planning. Instead, **plans for a LEZ should be fully integrated into local strategies and policies** for the growth and development of the city. This should start at the earliest opportunity, when plans for a LEZ start being drawn up.

Cities should ensure that the planning and consents system is aligned with the objectives of the LEZ. Land use planning principles should include minimising pollution. In the UK the National Planning Policy Framework provides guiding principles on how planning decisions should account for the impact of new developments on air quality. This guidance has been updated to refer specifically to the introduction of LEZs.

The planning process should be leveraged to support successful implementation of a LEZ. For example, when planning permission is granted for a new development, the decision could include requirements for measures to support low emission vehicles. This could include requirements to support parking and charging of compliant vehicles; and design and support for public transport, walking and cycling accessibility.

Oxford has implemented the following schemes and measures to support implementation of its ZEZ:

- **Grants and/or financing for vehicle charging points and/or zero emission vehicles.**
- **Electric car and van clubs.**
- **Freight consolidation or transfer schemes, including use of cargo bike schemes.**
- **Funding to trial new ideas or ways of working, such as exemplar delivery and servicing plans.**
- **Discounts or reserved spaces in car parks outside the ZEZ, such as park and ride sites).**

The municipality should also support local ambition by demonstrating leadership to business and residents in the way they act and operate. Local authorities and other public bodies operating within a LEZ should ensure that their vehicles, and vehicles operated on their behalf, meet the standards for the zone.

In the UK, government departments and related organisations must ensure that they meet Government Buying Standards. The transport standards set out minimum and best practice

criteria for different vehicle types. The use of these standards in procurement is encouraged for the wider public sector.

Key takeaways:

- **LEZs should be designed so that they support local plans for economic growth and are a positive asset for the city.**
- **Local plans, strategies, and the planning process should be leveraged to support successful implementation of a LEZ.**
- **Cities should lead by example in demonstrating LEZ compliance within their fleets.**

2.8 Accelerating transition to a zero emission society

LEZs are primarily designed to improve urban air quality by removing the oldest most polluting vehicles from the road. At the same time, **the transition to newer, lower emission vehicles is an opportunity to accelerate the transition to electric vehicles** (EV) and other zero emission tailpipe forms of transport. EVs maximise reductions in tailpipe emissions, compared to combustion engine vehicles, and contribute to net zero goals on climate change.

Partly because of the ZEZ, the UK's Royal Mail chose Oxford as its first all-EV city in the country. Other delivery and courier companies are also accelerating the transition to EVs in Oxford.

A LEZ can act as an opportunity to harness the transition to cleaner vehicles, and increased public awareness of environmental issues, as a driver for improving or introducing supporting infrastructure. This can be undertaken either directly by the municipality through policy approaches or through engagement with local businesses.

EV infrastructure measures can include:

- Residential on-street electric charging
- Rapid chargepoint hubs
- Charging at 'destination' points such as transport hubs, shopping centres and leisure facilities
- Charging at workplaces and business parks
- Chargepoints in EV priority access or delivery bays.

As noted earlier, there are certain vehicle types over which municipalities have a greater degree of direct control or influence. The LEZ provides an opportunity to take additional action to reduce emissions from these vehicle types by accelerating the transition to EVs.

Additional actions by the municipality could include:

- Purchasing, or mandating the purchase, of EVs to replace buses, refuse collection vehicles, and other vehicles in the city fleet.
- Requiring other public sector bodies such as the police to accelerate the transition of their fleets to EV.
- Tightening statutory requirements for taxis to mandate the registration of EVs for newly licensed vehicles.

London is implementing additional measures alongside the ULEZ including:

- **The deployment of 3,000 double deck hybrid diesel-electric buses, and 300 single deck electric or hydrogen fuel cell buses, by 2020.**
- **The requirement for all taxis licensed for the first time after 2018 to be zero emission capable, with a maximum 15 year age limit.**

Key takeaways:

- **LEZs are an opportunity to accelerate the transition to EVs.**
- **Cities can support this transition by increasing the provision of EV charging infrastructure.**
- **Cities can also leverage their control and influence over certain vehicle types to accelerate the pace of EV uptake.**

2.9 Associated actions to improve air quality

A LEZ can be a springboard for implementing other measures to reduce transport emissions. The previous section looked at the opportunity to accelerate EV uptake. However, moving from internal combustion engine (ICE) vehicles to EV does not help to reduce traffic congestion. A LEZ can also provide an opportunity for other actions to improve transport systems and reduce emissions. Examples of these are below.

Reduce unnecessary engine idling.

Unnecessary engine idling contributes to pollutant and greenhouse gas emissions. Municipalities may consider action on idling as part of communications activity and/or using their powers to enforce prevention of idling. Enforcement could be targeted at specific locations with known problems with idling, such as bus depots, taxi ranks, and freight delivery locations.

Promote sustainable travel.

Encouraging a shift to active travel and other forms of sustainable travel. Measures can include:

- **School travel planning** to encourage walking, cycling, and use of public transport.
- **Communications activity** around the potential health benefits of active travel and air quality.
- **Working with business, communities and schools** to encourage the provision of cycle racks and changing facilities.
- **Creating safe, continuous and convenient cycling and walking networks**.

Improve traffic management.

Improving traffic management in a LEZ can reduce emissions by reducing traffic and smoothing traffic flow, improving journey time reliability, and encouraging more active travel. Measures can include:

- **Improving road layouts and junctions**, or removal of unnecessary road humps, to improve traffic flow and create safer conditions for active travel.
- **Bus priority schemes** to improve reliability and journey times.
- **Public realm improvements** to create environments that are attractive for active travel.
- **Optimising traffic signal operation** to reduce unnecessary traffic.
- **Developing connected vehicle** and smart infrastructure solutions.
- **Using real-time information** to better inform travellers of their choices and manage demand.

Reduce emissions from construction machinery.

In some cities, emissions from construction machinery can be a significant source of air pollution. Construction machinery comprises equipment not used for the transportation of passengers or goods. It includes excavators, bulldozers and cranes used in construction. The engines in this type of machinery can emit significant pollutants, depending on their age, power rating, and intensity of utilisation. When introducing a LEZ, a city should assess the contribution to pollution of emissions from construction machinery. If modelling shows that impacts are significant, the city should engage with local businesses and encourage them to deploy newer, cleaner equipment in the zone.

Mitigate impacts of other emissions sources.

In some cities poor quality is caused by pollution blowing in from nearby agricultural areas, or from roadside dust and debris.

Emissions from field burning of **agricultural crop residue** is a common environmental hazard particularly in northern India. It has a significant potential health risk due to respirable suspended particulate matter. Cities can mitigate the impact of this by using vegetation to block flows of pollution into urban areas, as well as by using sprinklers and sweeping.

Road dust can be reduced by maintaining roads and repairing potholes; greening open areas, gardens, community places, schools and housing associations; and blacktopping road surfaces including pavements and road shoulders.

Key takeaways:

- **A LEZ can provide an opportunity for other actions to improve transport systems and reduce emissions.**
- **Measures can include reducing unnecessary engine idling, reducing emissions from construction machinery, promoting sustainable travel, and improving traffic management.**

3. Adding the Detail

3.1 Introduction

This section sets out the **operational standards and requirements** that cities should consider when setting up a LEZ. This covers the legal basis introducing a LEZ and potential legal challenges, vehicle standards for entering a LEZ, future proofing and future standards, vehicle detection, hours of operation, exemptions and discounts, charges (fees), payment mechanisms, data protection, engaging communities and businesses, and timescales.

3.2 Legal

Cities must ensure there is a legal basis for the design and implementation of a LEZ. This reduces the risk of a legal challenge being brought during the deployment phase, or if a challenge is brought, maximises the chances of the challenge being unsuccessful.

In the UK, the ability for city authorities to introduce a LEZ is set out in national legislation in the form of the Transport Act 2000. The Act empowers local authorities to make a local charging scheme in respect of the use of motor vehicles on roads.

The legal basis for introducing a zone should make clear that authorities have the powers to deal with the following matters:

- **Designating the roads** in scope of the LEZ.
- **Specifying emissions standards** and classes of vehicles subject to a charge.
- **Setting levels of fees** for non-compliant vehicles.
- **Determining how charges are made**, collected, recorded and paid.
- **Setting the duration** for which a scheme is in force.
- **Setting exemptions** and reduced rates from charges.
- **Operating enforcement regimes** and penalties for non-payment of charges.

In the UK zones are usually enforced at local levels via Traffic Regulation Orders (TRO). In this context, a TRO is a direct access restriction that can be used to ban vehicles not meeting specific criteria (in this emissions levels) from a specified area. TROs can be set up like any other access restrictions to apply either 24 hours a day or at certain times of the day. Cities in India should ensure they have similar powers available to them to support the implementation and enforcement of a LEZ.

Case Study: London.

- London's ULEZ, and in particularly its expansion in 2023 to cover Greater London, has been highly controversial.
- Several outer London councils launched legal action in February 2023, aiming to stop or delay this expansion. They argued that the Mayor of London, Sadiq Khan, had failed to adequately consult with businesses and residents, that the expansion was not wholly compliant with relevant legislation, and that insufficient data had been published to allow consultees to provide an informed response.
- Ultimately the high court dismissed this legal challenge, ruling that the legal basis for expansion was sound.
- However, this has generated negative publicity for the scheme and potentially increased opposition. After the zone was expanded in August 2023, small protests took place, and enforcement cameras were damaged.

Key takeaways:

- Cities must ensure there is a legal basis for the design and implementation of a LEZ.
- This should include relevant national or state-level legislation, plus city-level enforcement powers.
- Securing public acceptance can be challenging and there is a high risk of negative publicity.

3.3 Vehicle standards

Cities must **assess the sources of vehicle pollution to determine the relative contributions of private cars, buses, freight, taxis, and powered two- and three-wheelers**. Using this data, they can then determine which vehicles will be in scope of the zone and set appropriate standards, to ensure that only the cleanest vehicles are encouraged to enter the LEZ. Vehicles that conform to more recent emissions standards should emit less pollution than older vehicles in their class.

In the UK, the greatest sources of road transport pollution are usually heavy duty vehicles (trucks, buses and coaches), and high utilisation vehicles such as taxis. This may vary in India so cities will need to establish their own major pollution sources.

After the authority has decided what vehicles are in scope, and set appropriate emissions standards, other vehicles should be subject to a charge unless they are covered by an exemption or discount on the charge, or comply in another way such as meeting retrofitting requirements.

Vehicles which could be allowed to enter a zone without paying a daily charge could include:

- **Petrol and diesel vehicles which meet the most stringent national emissions standards.**
- **Plug-in hybrid vehicles** which have lower emissions than ICE vehicles.
- **Fully electric and hydrogen fuel cell vehicles** which have zero tailpipe emissions.
- **Vehicles which have been retrofitted** to meet one of the above criteria.

Retrofitting a vehicle can be a cost-effective alternative to buying a new vehicle to comply with LEZ standards. Retrofitting is more likely to be cost-effective for high value vehicles, or vehicles fitted with specialist equipment. It is less likely to be cost-effective for passenger cars. Vehicles which are old and in poor general mechanical condition may not be suitable for retrofit. It is recommended that an accreditation scheme is set up so that businesses and consumers can select an appropriate company to undertake the retrofit work.

Key takeaways:

- **City authorities will need to assess the sources of vehicle pollution to determine which vehicles will be in scope of the zone and set appropriate standards.**
- **The greatest sources of road transport pollution are usually older heavy duty vehicles and high utilisation vehicles**
- **Retrofitting a vehicle can be a cost-effective compliance mechanism for high value vehicles, or vehicles fitted with specialist equipment.**

3.4 Future proofing

LEZs should be ambitious schemes that reflect the best environmental performance and aim to deliver the best long-term outcomes. LEZ standards should be regularly reviewed and updated to ensure they remain ambitious and reflect technology progress.

It may not be appropriate to set LEZ standards in the short-term that only allow zero emission tailpipe vehicles to enter the zone without paying a charge, unless the zone is very small in size. This puts a substantial cost onto businesses and consumers, who would need to either invest in a new vehicle, or pay a daily charge every time they enter the zone. This would be particularly challenging for low income households and small businesses, who may not be able to absorb these additional costs. Instead, **it may be best to set up the zone based on the latest ICE standards, but review this periodically to determine an appropriate time to tighten zone standards.**

The UK government has announced its intention to phase out the sale of new petrol and diesel cars in the UK. by 2030. From 2035, only new cars and vans with zero tailpipe emissions can be sold. This policy certainty will lead to increased uptake of EVs in the UK over the next few years. At some point in the next decade, cities may decide to tighten their LEZ standards to only allow entry without paying a charge to zero tailpipe emission vehicles.

Businesses and individuals need sufficient certainty to plan and make the best decisions in response to LEZs. As such, cities should give sufficient warning before changing vehicle standards. In the UK, government has confirmed that the standards for the zones already in place will be constant until at least 2025.

- **Oxford has launched a small-scale pilot ZEZ to test effectiveness and consumer acceptance. If it is successful, it could be expanded to cover more of the city.**
- **The Mayor of London initially stated an ambition to introduce a ZEZ by 2030; this commitment has been replaced by a plan to support councils within London which want to introduce local ZEZs.**

Key takeaways:

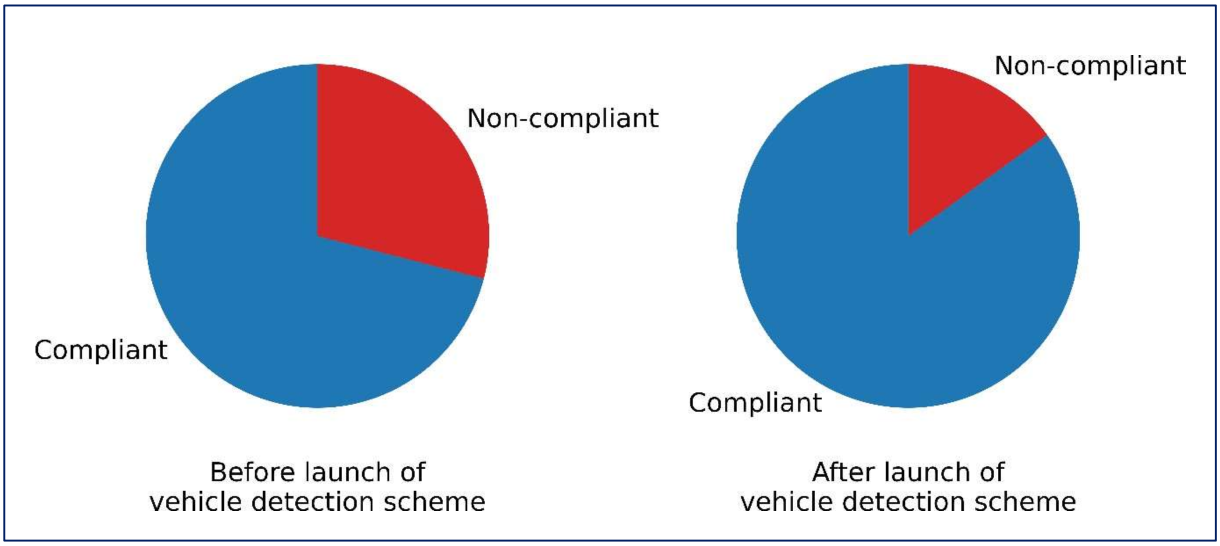
- **LEZ standards should be regularly reviewed and updated to ensure they remain ambitious and reflect technology progress.**
- **Implementing a zero emission vehicle only standard in the short-term may impose unfair costs on low income households and small businesses.**
- **Businesses and individuals need certainty to make the best decisions in response to LEZs – cities should give sufficient warning before changing vehicle standards.**

3.5 Vehicle detection

Cities will need a mechanism of detecting vehicles entering the zone, or driving within the zone, and to check whether these vehicles meet emissions standards, have an exemption, or have paid the daily charge.

In the UK, all LEZs are managed by a network of cameras equipped with automatic number plate recognition technology (ANPR). Other vehicle detection strategies, such as visible stickers and manual checks by enforcement officers, could save money compared to ANPR systems. However, compliance rates are likely to be lower, there is greater opportunity for fraud and abuse, and manual enforcement may be impractical for spatially large zones.

The chart below shows that compliance rates with Bristol's LEZ increased from 71% prior to scheme deployment, to 85% after launch.



Where ANPR is used, cameras capture all vehicles on the monitored roads, regardless of whether it is their trip destination, or they are passing through the zone. The camera networks have a back office system which compares the vehicle details against a database of registrations to check for compliance.

The number and location of ANPR cameras is critical to the effective monitoring of vehicles entering and moving within a LEZ. 'Boundary cameras' should ideally be installed at all points of entry into the LEZ. If this is cost-prohibitive, cameras should be located where they will cover the highest traffic flow roads and junctions. Additional cameras are needed inside the LEZ to identify vehicles that move within the LEZ and therefore escape detection by boundary cameras.

Boundary cameras are typically fixed, as they are located at points of entry. Cameras inside the LEZ can be a combination of fixed and mobile cameras. The latter can help reduce the total number of cameras needed, and associated costs, while helping maximise detection rates. Cameras inside the

zone should be co-located with signage that inform drivers they are within the LEZ and that cameras are in use.

It is difficult to estimate how much camera coverage is required for a given city as this depends on multiple variables including zone size, traffic flows, number of entry points, and desired capture rate. Increasing capture rate will most effectively influence driver behaviour and maximise air quality benefits. However, this will come with a high cost for camera hardware, back office systems, and management and administration.

London is developing a significant ANPR camera network to enforce the ULEZ. Prior to the expansion of the ULEZ in 2023, this comprised:

- **Approximately 237 enforcement ANPR cameras in inner London.**
- **An additional 1,156 cameras in a ‘middle ring’ between inner and outer London.**
- **An additional 106 cameras across outer London.**

Approximately 2,750 additional cameras may be needed to effectively operate and enforce the enlarged ULEZ.

Prior to launching its LEZ, Bristol City Council forecast they would need over 2,700 cameras to enforce the scheme, at a capital cost of £100m-£150m.

Cameras should not be installed to ‘catch out’ drivers who are unaware they are driving into or within a LEZ. **Appropriate signage should be installed on major access routes heading towards the LEZ boundary, at the boundary, and inside the LEZ, to notify drivers of the scheme.** Signage should also show alternate routes for those who wish to divert around the LEZ.

Bristol has a range of signs (examples shown in the pictures below) to give information about the LEZ:

- Advance warning signs: Used on roads approaching the zone boundary and positioned where you can choose to take an alternative route. There may also be a camera enforcement sign.
- Direction signs: Used on the approaches to the zone boundary, often instead of advance warning signs.
- Entry signs: These are the boundary signs at the exact point where the zone starts. There will also be a camera enforcement sign.
- Exit signs: These are the boundary exit signs showing that you are now leaving the zone.
- Repeater signs: These are within the zone to remind you that you are driving in the zone and there is camera enforcement.

Key takeaways:

- Cities will need a mechanism for detecting vehicles entering or driving in the zone, and for checking compliance and/or payment of a daily charge.
- All UK LEZs are managed by ANPR cameras. Other options are available which could be cheaper but less effective and impractical for large zones.
- Appropriate signage should be installed on access routes heading towards the LEZ, at the boundary, and inside the LEZ.

3.6 Hours of operation

There are broadly two options for setting the hours of operation of a LEZ:

- **Enforce the zone 24 hours a day.**
- **Enforce the zone for a limited and defined period each day.**

There is an argument for only enforcing the zone during a limited period. Pollution emissions are typically higher at peak times, and (by definition) traffic congestion levels are highest in the morning and afternoon peaks. Operating the zone only during daytimes, or only at morning and afternoon peak times, would give drivers confidence that the zone is only being used to target and improve poor air quality, rather than to raise revenue.

However, pollution can build up and persist for long periods, depending on metrological conditions, so concentrations can be high outside of peak times. Public exposure to high concentrations is harmful irrespective of when the pollution was emitted.

There are also two behaviour-related drawbacks to a time-limited approach:

- **Non-compliant vehicles** may shift their times of operation to hours when the zone is not in force and as such there would be no reduction in total emissions, although there is no evidence of this happening in time-bound schemes in the UK.
- There may be **negative impacts on congestion and safety** around the times when zone comes into and out of force. For example, drivers rushing to complete journeys in the zone before it starts, or queuing outside the zone waiting for it to stop before entering.

On that basis, LEZs in the UK operate for twenty four hours a day, seven days a week. This maximises the impact of the scheme and therefore maximises the health benefits.

LEZ hours in the UK:

- **All LEZs in the UK – including London's ULEZ – operate 24 hours a day.**
- **Oxford's ZEZ pilot operates from 7am to 7pm, seven days a week.**

Key takeaways:

- **LEZs could be operational 24 hours a day, or for a limited period each day.**
- **Operating the zone 24 hours a day maximises the benefits, simplifies the messaging and minimises potential negative consequences.**

3.7 Exemptions and discounts

In earlier sections we stated that all vehicles defined as in scope of the zone should pay a daily charge if they do not comply with set emissions standards. However, **there will be cases where exemptions and discounts from a charge will be appropriate**. Examples of such cases are:

- **People's personal circumstances**, such as disability, or lack of financial means to pay or comply.
- **Vehicles for which compliance may be challenging** or financially punitive.
- **Vehicles with unique or niche operational duty cycles** that make compliance challenging.
- So-called **'sunset periods'** allowing certain individuals, businesses, or vehicle types additional time to comply with zone requirements. In the UK a typical sunset period for LEZs is three years.

Exemptions can be provided in the form of a 100% discount. This gives the city the flexibility in the future to change to a partial discount. This is likely to be easier and more widely accepted than changing from full exemption to full enforcement.

Cities in the UK generally exempt most or all the following from paying a charge to enter a LEZ:

Typical LEZ exemptions in the UK

- **Non-road going vehicles** which are allowed to drive on the highway such as agricultural machines, digging machines, and mobile cranes.
- **Historic, military, and emergency vehicles.**
- **Vehicles used by a disabled person.**
- **Community transport**, such as minibuses, which support access to employment, education and training for potentially marginalised people.
- **Residents who live within a LEZ** are usually provided with either an exemption, or a sunset period to reach compliance. Consideration should also be given to residents in areas adjacent to the zone, particularly if these are low income neighbourhoods.
- A similar approach as that for residents is taken for **businesses based in the zone.**

The UK government advised that exemptions should be minimised, to maximise the benefits of a zone. However, in the experience of cities which have implemented LEZs, **a generous program of exemptions and discounts can increase citizen acceptance and mitigate negative impacts on vulnerable groups.**

On balance, **exemptions should be provided where necessary to ensure the scheme is fair and equitable, while avoiding negating the overall benefits of the zone.** Striking this balance depends on modelling of the change needed in vehicle mix to meet a zone's air quality aims, and the social and economic impacts of a zone's introduction.

In addition to the exemptions listed above, Oxford also provides discounts on its ZEZ to:

- **Health or care workers.**
- **Students in financial hardship moving in or out of the zone.**

Key takeaways:

- **Exemptions and discounts from LEZ charges will be appropriate in some cases.**
- **Exemptions can be provided in the form of a 100% discount, which provides flexibility for future changes.**
- **Exemptions should be provided where necessary to ensure the scheme is fair and equitable, while avoiding negating the overall benefits of the zone.**

3.8 Levels of charge

There are broadly three options for determining how non-compliant vehicles are treated:

- **A 'non-charging' LEZ** would work on a voluntary basis, with no consequences for non-compliant vehicles entering the zone.
- Zones could implement **a total ban** on the operation of non-compliant vehicles.
- **Non-compliant vehicles could enter the zone**, if they pay a daily charge (fee) to do so.

A **non-charging zone** may be the most easily accepted by residents and businesses. However, it is unlikely to have high compliance rates and may not significantly improve air quality.

A **total ban** on non-compliant vehicles would maximise air quality improvements. However, it is likely to be highly unpopular with residents and businesses. It may require the authority to provide lots of discounts and exemptions which would be challenging to administer, and/or reducing the hours of operation. Finally, there would be challenges with enforcement – in the UK, this would need to be carried out by the police, rather than the municipality.

A charging zone or fee-paying zone can overcome these challenges. It can (in the UK) be enforced by the city authority, and the city can tailor it to allow discounts and 'sunset periods' for specific vehicles and types of road user. It allows any vehicle to gain access if necessary. Importantly, this option can generate revenue, which can cover the costs of operating the scheme, including funding discounts and exemptions. It is seen as more sophisticated than an outright ban, according to cities which have considered both options, as it allows the setting of different fee levels for different vehicle types.

Cities should set fees at an appropriate level, reflecting local circumstances, and likely scheme operational costs. This needs to be high enough to encourage behaviour change, but without unfairly impacting people on lower incomes for whom the cost of adaptation may be relatively high. ZEZs should not be implemented as a revenue raising measure for cities. Surplus revenue should be reinvested in other sustainable transport measures.

Oxford's daily charges for entering the ZEZ in a non-compliant vehicle are shown in the table below:

Vehicle Band	Emissions	Daily charges	
		2022	2025
Zero emission	0 g/km CO_2	£0	£0
Ultra low emission	1-75 g/km CO_2	£2 (₹200)	£4 (₹400)
Low emission	Euro 6 diesel Euro 4 petrol	£4 (₹400)	£8 (₹800)
Other vehicles	Higher than above	£10 (₹1000)	£20 (₹2000)

Key takeaways:

- **A charging zone or fee-paying zone is the preferred option, compared to a voluntary zone or outright ban on non-compliant vehicles.**
- **Cities should set fees at a high enough level to encourage behaviour change, without unfairly impacting people on lower incomes.**
- **Cities should reinvest net income from LEZs into sustainable transport projects.**

3.9 Payments and fines

As noted earlier, a LEZ could be introduced without fees, on a voluntary or non-charging basis. However, this is unlikely to have high compliance rates and may not significantly improve air quality. In addition, without a fee there are no sources of revenue to cover operational costs. It is likely that a fee, typically levied daily on non-compliant vehicles, will be required to encourage behaviour change and accelerate use of low emission vehicles. **Cities therefore need to implement a mechanism for drivers to pay fees, and to consider how they will tackle drivers entering the zone in a non-compliant vehicle without paying the charge.**

Payment systems need to be reliable and easy to use. Functionality should include the following.

- **A mechanism for drivers to check** whether they have entered the zone.
- **An accounts system** for storing vehicle and payment details.
- **A mechanism to add credit** to draw down to pay charges.

A poorly designed or unreliable system will lead to complaints and negative publicity against the scheme.

London's ULEZ payment systems. London has set up 'Auto Pay' and 'Fleet Auto Pay' to facilitate the process of paying ULEZ fees, and remove the risk of a fine being issued for non-payment. Auto Pay is intended for use by individual drivers and micro-businesses. Fleet Auto Pay is available to businesses with six or more vehicles. Drivers register their details including payment information online. They are then billed monthly for the number of charging days their vehicle was identified within the ULEZ. In addition to providing convenience for users, these systems reduce the administrative burden on the transport authority (Transport for London).

In the UK, regulations state that administrators of a road user charging scheme (such as a LEZ) may impose a penalty charge for non-payment of fees. The penalty charge is imposed by issuing a Penalty Charge Notice (PCN). Administrators have the power to set different rates of penalty charge for different days of the week, times of day, parts of a charging area, and classes of vehicles.

Levels of penalty charge should act as a deterrent effect, encouraging drivers to pay the fee rather than receive a PCN. Equally, they should account for the local socio-economic context and not be unnecessarily punitive on drivers. City authorities can provide discounts on set penalty levels for prompt payment.

PCN schemes can be expensive to administer, primarily for staff to review and process notices before they are issued. This can be undertaken in-house or by an external contractor.

A sunset period should be used in which warning letters are issued to drivers of non-compliant vehicles entering the zone without paying the fee. The learning from the UK is that this period should be several months in duration, to maximise the number of drivers receiving a warning.

In London, the penalty charge for non-payment of ULEZ fees is £180, discounted to £90 if paid within 14 days. In Oxford, the maximum penalty is £120, with a 50% discount for prompt payment.

Key takeaways:

- **Cities need a mechanism for drivers to pay fees, and a process for dealing with drivers entering the zone in a non-compliant vehicle without paying the charge.**
- **Online payment systems, ideally with automated billing, provides benefits for drivers and scheme administrators.**
- **Levels of penalty charge should act as a deterrent effect, encouraging drivers to pay the fee rather than receive a PCN.**

3.10 Engaging citizens

Citizen acceptance is crucial to the successful implementation and operation of a LEZ. The experience from the UK is that citizens are more likely to engage with, and support, initiatives if they have first-hand experience of the problem being addressed, and if action to address it is highly visible.

Local and transport authorities have a responsibility to raise awareness of new road user charging schemes. In the consultation period and prior to launch of a LEZ, publicity aimed at citizens should seek to enlist the support of people and communities.

There are three main areas to include in any citizen engagement activity:

- **The health impacts of poor air quality.** Citizens may not be motivated to support a scheme purely for environmental reasons, particularly where they are paying a price in the short-term, while the benefits are realised in the long-term, or at a global scale. Instead, messaging should focus on the health impacts of pollution and the benefits to citizens of improving air quality. In the UK, successful campaigns around LEZs have used Directors of Public Health to act as local champions on air quality improvement.

- **Action that can be taken to improve air quality.** Focus on what the city is doing, and what individuals can do, to ensure people feel empowered to act rather than anxious. Aim to stimulate citizen action by focusing on behaviour change such as using low emission vehicles or switching to other modes of transport.

- **Progress and benefits**. Regularly share information with citizens on improvements to air quality, whether these are attributable to the LEZ, or to other actions such as the purchase of electric vehicles by the municipality. In the UK cities have typically reported progress annually, but some recommend making this monthly to increase transparency with citizens.

Engagement activity campaigns should leverage social, local, and other media to engage different citizen groups. When selecting campaign channels, consider the need to reach citizens who may live outside the planned LEZ area. Innovative campaign channels might include:

- **Communications campaigns** based around 'Clean Air' days, encouraging people to use sustainable transport or active travel.
- **Interactive websites**, using live pollution monitoring. Refer to the next section for more guidance on websites.
- **Education activities** in schools, community groups, health centres and doctors' surgeries.
- **Engagement via stakeholders** including political representatives and organisations, other cities and neighbouring states, charities, businesses, transport and road user groups, and health and environmental community organisations.

Bristol Council published a toolkit for individuals to help them find out how the zone works and how they can help make the air we breathe cleaner. The guide includes:

- **General information about the LEZ: what it is and how it works, location, and how to know if you've driven in the zone.**
- **Financial information: how to pay, financial support, temporary exemptions, free travel vouchers, free loan bikes, cycle training, journey planning, avoid excessive idling.**
- **Dissemination: resources for individuals to share communication on the LEZ, including guidance on making a video; sharing in an email, newsletter, or on social media.**

The toolkit has helped build support for the LEZ and encouraged residents to think about their travel choices. It was supported by a communication campaign involving messaging on buses, radio, at petrol forecourts, and on social media. The campaign focused on the health benefits of the scheme, particularly for children and the elderly.

Campaigns should target residents in areas around the zone, as well as within the zone.

Evaluation of Bristol's outreach found very high awareness of the scheme within the LEZ area, but almost zero awareness among citizens living further afield how may need to access the zone from time to time. Ideally a local LEZ should be signposted on major roads leading to the city to give drivers plenty of warning that they may enter a LEZ. However this is outside the of the local authorities traffic jurisdiction. Therefore Bristol advertises the presence of their LEZ on petrol forecourt pumps outside of the city.

Key takeaways:

- **Citizen acceptance is crucial to the successful implementation and operation of a LEZ.**
- **Campaigns should focus on the health impacts of pollution and the benefits to citizens of improving air quality. Independent local champions should be used.**
- **Citizen engagement could include 'Clean Air' days, interactive websites, education activities, stakeholder engagement and promote more suitable travel alternatives.**
- **LEZ should be signposted on major roads leading to the city.**

3.11 LEZ Website

In the UK, cities with a LEZ have set up websites to provide information about the zone to citizens and businesses. Websites should include the following:

- **Introduction to the LEZ**: what a LEZ is, why the city needs one and its objectives.
- **Overview of LEZ charges and a vehicle checker**: allows drivers to check if their vehicle will be charged and how to pay.
- **Payment portal:** a mechanism to pay the daily charge if vehicles don't meet the required emission standards.
- **A map of the LEZ:** clearly showing boundaries and entry/exit points.
- **Exemptions**: information on exemptions and discounts from the daily charge.
- **Traffic signs:** descriptions and pictures of LEZ traffic signs and where they are used.
- **Pay a PCN**: details of when a PCN may be issued and how to pay.
- **Revenue**: information on how revenue from daily charges and PCNs is used.
- **Appeals**: a clear process for appealing a PCN.
- **Refunds**: a clear process to apply for a charge refund, including details of who can apply for a refund.
- **Financial support:** information on what financial support is available, who can apply, how to register your interest.
- **Active travel support**: advice on reducing car journeys, for example with cycling or walking.

The website can also host the citizen and business engagement toolkits described elsewhere in this document.

Key takeaways:

- **A website, optimised for computer and smartphone use, will be an effective tool for communicating with citizens and businesses.**
- **Websites should provide clear information about the LEZ, and offer a simple process for checking compliance and paying charges.**

3.12 Engaging businesses

Engagement with businesses will also be crucial for the successful implementation of a LEZ. This should cover businesses which may operate vehicles in the zone, as well as businesses based in the zone which receive deliveries and customers via road transport. Businesses are a key audience: they can play an important role in improving air quality through how they operate, and by influencing their employees' behaviour.

An engagement campaign should focus on how a LEZ can benefit businesses by making the city a healthy and attractive place, attracting investment and customers. In the UK, successful business engagement campaigns have focused on encouraging businesses to:

- **Participate in sustainability programmes.** For example to improve driver behaviour and raise employees' awareness of clean air.
- **Commit to use only their lowest emission vehicles in a LEZ**. Only purchase new vehicles that meet LEZ standards.
- **Make operational decisions that support LEZ implementation**. This can include items such as requiring suppliers to use LEZ-compliant vehicles.

Business engagement can be undertaken directly, or indirectly via Chambers of Commerce or similar local forums. Alternatively, a new forum can be established for local businesses to share best practice and develop action plans.

A **system of incentives and rewards** can be put in place to support businesses which make improvements. These could be low cost schemes such as recognition of LEZ-compliant businesses, or financial support in the form of preferential business for businesses which take significant measures to reduce transport emissions.

The LEZ can also be a lever to encourage businesses to take other measures to reduce emissions, in addition to changing to cleaner vehicles. These could include:

- **Journey planning** to reduce total vehicle kilometres travelled.
- **Reducing unnecessary vehicle idling.**
- **Consolidating deliveries** in partnership with other businesses.
- **Flexible working** for employees.

Bristol Council published a toolkit for businesses to help them find out how the zone works and how they can help make the air we breathe cleaner. The guide is similar to the toolkit for citizens and includes:

- **General information about the LEZ: location, how to know if you've driven in the zone, LEZ standards, charges and how to pay, exemptions, and information on keeping informed.**
- **Support and guidance: how to check your fleet, signposting financial support including funding for small businesses and funding for EV charging infrastructure, information on support for individuals travelling into the zone for work, additional free travel support, and advice for businesses on undertaking travel audits and improving staff travel policies.**
- **Dissemination: resources for businesses to share and communication on the LEZ, including video testimonials, suggested email, newsletter, social media and website content, and information on Bristol's 'Clean Air Champion' scheme.**

The toolkit discussed in the box above has been useful in securing buy-in from businesses and ensuring they know what to do to comply with the zone to avoid fines. It was supported by an engagement campaign including business visits, events and roadshows, online business meetings and webinars, telemarketing, and letters. The council recruited dedicated staff to deliver this campaign.

LEZs can be introduced alongside other measures to make streets feel safe and comfortable for people to walk and spend time. Doing so can bring economic benefits for local businesses. A study in London found that high street walking, cycling and urban realm improvements increased retail sales by up to 30 per cent; and provided an uplift in office and retail rental values of four per cent and 7.5 per cent per annum, respectively.

Key takeaways:

- **Business engagement is crucial for the successful implementation of a LEZ.**
- **Campaigns should focus on how a LEZ can make the city healthier, attracting investment and customers.**
- **Alongside the LEZ, consider using the campaign to encourage businesses to take other measures to reduce emissions, such as journey planning and delivery consolidation.**

3.13 Timescales

It is important that cities implementing a LEZ give citizens and businesses choices about how to respond, and enough time to make these choices. Plans and parameters for a LEZ should therefore be published as early as possible, to allow as much time as possible between announcing the scheme and it starting to operate. The more time consumers and businesses have to respond to the LEZ, the easier it will be for them to do so. In turn, this means they are more likely to accept and be supportive of the scheme. Equally, this must be balanced against the ongoing health impacts of not taking action to improve air quality. In any case, significant time will be needed for the city to prepare to operate the LEZ, including recruiting staff and procuring hardware, software and back office systems.

Implementation timetable for London's ULEZ:

- **Pre-2014: Proposal development by Transport for London and the Mayor's office.**
- **2014 to 2015: Public consultation on plans for a central London ULEZ.**
- **2015: Confirmation that a central London ULEZ will be implemented.**
- **2019: ULEZ launched in central London.**
- **2023: ULEZ expanded to outer London.**

Implementation timetable for Oxford's ZEZ:

- **2015: A ZEZ for Oxford is identified in the Oxfordshire Local Transport Plan.**
- **2017: A feasibility study proposes options to improve air quality in Oxford city centre. The city consults on initial proposals.**
- **January 2019: The city publish updated proposals, based on responses to the initial proposals.**
- **January 2020: An informal consultation is held on the updated proposals.**
- **November 2020 to January 2021: A formal consultation on the ZEZ pilot runs for eight weeks.**
- **March 2021: The city reports findings of the formal consultation and approves the ZEZ pilot scheme.**
- **February 2022: Launch of the ZEZ pilot.**

4. Justification and Impact Assessments

4.1 Introduction

In implementing a LEZ, **cities need to consider the impact on citizens and businesses, and the need for mitigating measures**. This is carried out via an impact assessment, and is an important part of planning for a LEZ. This section introduces the key concepts and aspects of undertaking an impact assessment, covering high-level guidance and methodology, benefits and costs to bring into scope of an assessment, advice on developing the business case, assessing impacts on businesses and households, and a case study on vehicle scrappage as a mitigating measure.

4.2 Overview and guidance

The purpose of undertaking an impact assessment is to identify – and aim to quantify – the major impacts associated with the scheme. Outputs can be used to define the parameters of the zone, including vehicle standards. Outputs can also be used to design measures to avoid or mitigate negative impacts, and enhance positive impacts. Impact assessments should be undertaken at the planning stage so they can be carried out for a range of options, such as different vehicle and emissions standards, or spatial coverage.

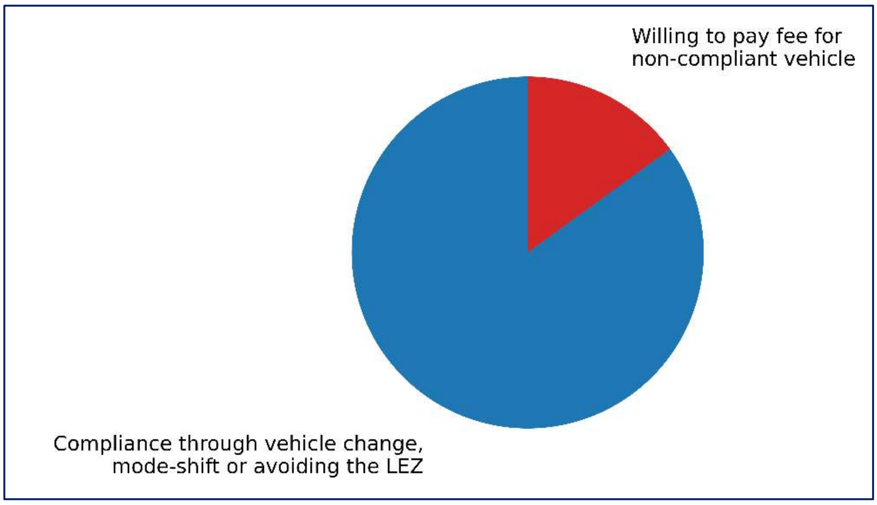
Best practice impact assessments of LEZs in the UK typically include four themes:

- **Environment**: the primary environmental impact is likely to be on air quality. Secondary impacts could include greenhouse gas emissions.
- **Health**: impacts on citizens' health and wellbeing.
- **Equality**: impacts on potentially vulnerable or marginalised groups.
- **Business**: impacts on the city's economy, particularly small businesses.

The starting point for undertaking an impact assessment is to understand the options available to drivers and businesses when a LEZ is launched. For a fee-based scheme of the type described in this document, there are broadly four options for drivers:

- **Switch to a compliant vehicle**. Depending on the proposed zone fee for non-compliance, this should be the most economically advantageous option for frequent travellers into the LEZ.
- **Avoid entering the LEZ.** Drivers may route around the zone, use a different mode of transport, or not travel at all.
- **Enter the LEZ and pay the fee**. This may be appealing for drivers who only enter the zone occasionally.
- **Redeploy vehicles.** Businesses with multiple vehicles could reallocate their fleet to ensure only compliant vehicles are used in the LEZ.

The chart below shows the results of one consultation question in Oxford. Only 15% of respondents said they would use a non-compliant vehicle in the ZEZ and pay the charge. 85% said they would use a zero emission tailpipe vehicle, change mode of transport or time of travel, or not enter the zone at all.



There is no prescribed way of undertaking an impact assessment. An outline methodology would comprise:

- Quantifying the expected benefits and costs of the scheme.
- Undertaking or commissioning business case assessment.
- Assessing impacts on businesses and citizens.
- Considering mitigating measures, such as vehicle scrappage.

Each of these is covered in the following sections.

Key takeaways:

- **Cities should carry out an impact assessment to consider the impact on citizens and businesses, and the need for mitigating measures.**
- **Themes in scope of a typical impact assessment are the environment, health, equality, and business.**
- **Drivers can respond to a LEZ by switching to a compliant vehicle, avoiding the LEZ, entering the LEZ and paying the fee, or (in the case of businesses) redeploying vehicles.**

4.3 Benefits

The extent to which the LEZ tackles the 'triple challenge' of air pollution, climate change, and traffic congestion should be considered in the impact assessment.

Air pollution

The potential reduction in pollution concentrations should be modelled using data from air quality monitoring stations and forecasts of how drivers will react to the LEZ, including switching to lower emission vehicles. The following data on the vehicles on the road will be required:

- **Forecast number of vehicles affected,** disaggregated by vehicle category and pollutant emissions standard.
- **Average kilometres driven annually by each vehicle category**, to allow estimation of total vehicle kilometres driven by compliant and non-compliant vehicles in each category.

The UK government publishes costs associated with the health and economic impacts of poor air quality, and guidance on applying these costs. The 'cost' associated with the emission of a unit of pollution can be multiplied by the forecast reduction in emissions due to the LEZ to estimate the total social monetary value of the scheme.

Climate change

LEZs are designed primarily to reduce air pollution emissions. This is achieved in part by encouraging people to switch to newer vehicles. Newer vehicles are on average more fuel efficient than older vehicles and therefore will have slightly lower greenhouse gas emissions. As such, LEZs may have a marginal benefit in relation to climate change targets.

Some drivers will use the opportunity of purchasing new vehicles to switch to electric vehicles. These have significantly lower greenhouse gas emissions than petrol or diesel vehicles, even accounting for the emissions associated with vehicle manufacture and electricity generation.

Modelling should estimate the potential reduction in greenhouse gas emissions associated with a LEZ, and use standardised values to monetise this benefit. Modelling should include factors such as activities associated with model shift to active travel and public transport.

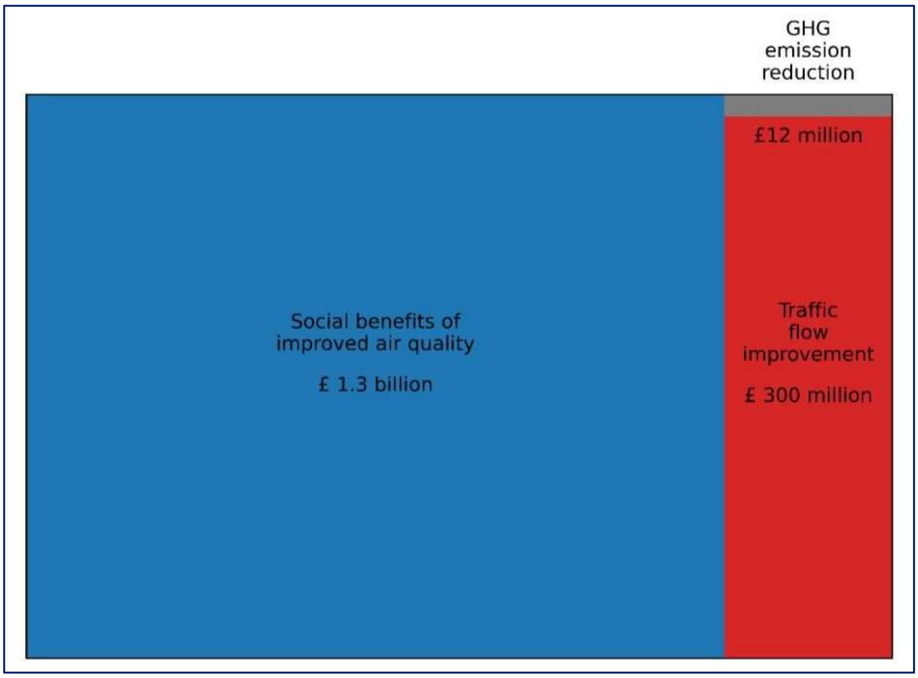
Traffic congestion

Drivers might respond to the LEZ by routing around the zone, using a different mode of transport, or not travelling at all. Fewer vehicles operating in the LEZ will have traffic flow improvements, reducing journey times and increasing journey time reliability. The latter is particularly important for encouraging people to use buses instead of driving.

In the UK, the government publishes data on the value of time, with monetary values which can be used to estimate the total benefit to society of improved traffic flow. Where available, this should also be included in modelling of the benefits of a proposed LEZ.

Oxford has seen a 20% reduction in vehicle movements within the ZEZ since its launch.

The chart below shows the headline finding from the UK government's impact assessment, which aimed to forecast the potential benefits of five LEZs plus London's ULEZ. It found that the social benefits resulting from improved air quality would be valued at £1.3 billion, even accounting for the reallocation of polluting vehicles to other areas. The study also forecast benefits worth over £300 million from traffic flow improvements, and £12 million from reductions in greenhouse gas emissions.



Key takeaways:

- **Modelling should be undertaken to quantify the benefits of a proposed LEZ, focusing primarily on air quality, and including secondary benefits such as reduced greenhouse gas emissions and improved traffic flow.**
- **Subject to the availability of standardised factors, benefits should be monetised to show the total social value of the scheme.**
- **In the UK, the government estimated that the social benefits resulting from improved air quality associated with five LEZs plus London's ULEZ would be valued at £1.3 billion.**

4.4 Costs

The monetised benefits of a proposed scheme should be compared to forecast costs, to determine whether it represents good value for money. There are broadly two cost elements to consider:

- **Implementation costs** to set up and operate the LEZ.
- **Costs to drivers** based on the actions they take in response to the scheme.

Implementation costs include:

- **Professional services**: resources to design the scheme and carry out business case assessments, undertake consultations, and complete modelling work as described in this toolkit. This may require in-house staff within the municipality, and external contractors.
- **Hardware and infrastructure**: enforcement cameras, signage, and IT equipment.
- **Software and back office systems**: solutions to manage payments and enforcement.
- **Running costs**: staff to set up and administer the scheme, and maintenance contracts for hardware and software.

Costs can be estimated by requesting quotes from potential suppliers.

Costs to drivers include:

- **Welfare loss**: the expenditure incurred by non-compliant vehicle owners who upgrade to a compliant alternative.
- **Lost value of assets**: the reduction in the value of older vehicles, which lose value because they can't be used in the LEZ without the driver paying a charge.
- **Cost of avoided trips**: costs incurred by drivers changing route (increasing time and mileage), using another mode of transport, or not travelling at all.

Costs can be estimated by developing scenarios for responses to the LEZ, estimating values for individual drivers, then multiplying by the number of individuals expected to be affected.

Municipalities operating a charging scheme will earn revenue from drivers paying to use a non-compliant vehicle in the zone. Revenues can offset the costs of scheme setup and operation. In the UK, surplus revenues from road user charging schemes (after costs have been covered) must be reinvested to support other transport policies in the city. This could include helping citizens and businesses switch to electric vehicles, for example. This approach helps secure citizen acceptance of the LEZ, as it is not seen as a tax-raising scheme by the city.

The chart below shows the headline finding from the UK government's impact assessment, which aimed to forecast the potential costs of five LEZs plus London's ULEZ. The study forecast the following (all costs over a 10 year assessment period):

Forecast costs to drivers:

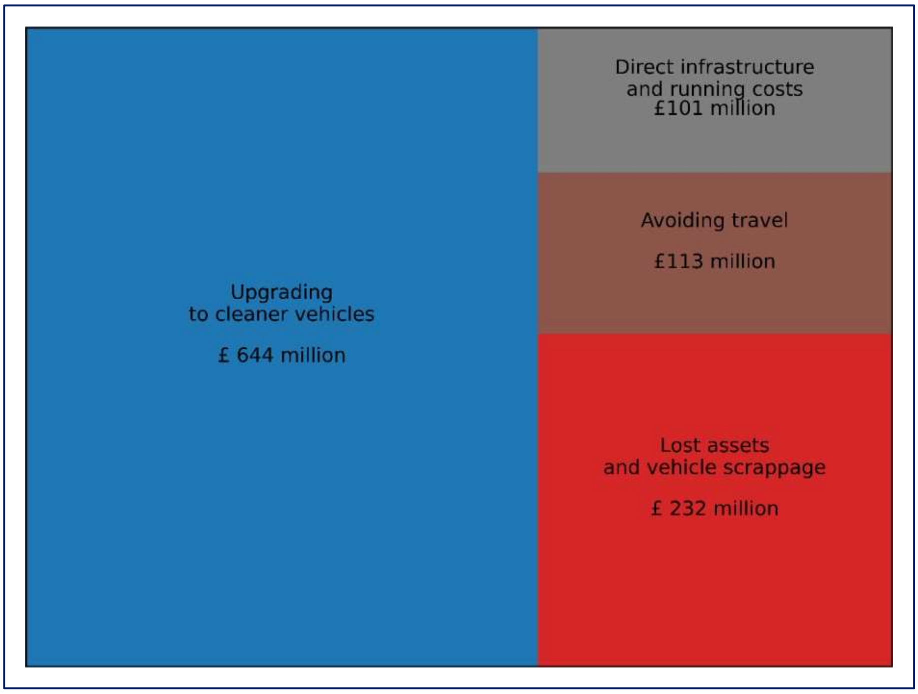
£644 million: Direct costs incurred by drivers choosing to upgrade to cleaner vehicles.

£232 million: Direct costs incurred by drivers because the second-hand value of non-compliant vehicles falls, and through early scrappage of vehicles that may otherwise have been resold.

- **£113 million**: Indirect or welfare losses to individuals who don’t travel at all because of the LEZ, and therefore miss out on economic or social opportunities.

Forecast costs to city authorities:

- **£101 million**: Direct infrastructure and running costs to set up and operate the scheme.



The forecast costs for Bristol’s LEZ are shown in the table below:

Item	Estimated costs
Capital Costs (CapEx): System	
• Cameras and back office	£19,100,000
• Street works (including power and signage)	£3,740,000
Capital Costs (CapEx): Supporting Measures	
• Vehicle upgrade scheme	£42,000,000
Total Scheme Capital Cost	**£42,000,000**
Operational Costs (OpEx) (Annual)	
• Scheme operations	£2,680,000

• Maintenance and support	£562,000
• Other costs (including staff and monitoring)	£772,000
Total Operational Costs (OpEx) (Annual)	**£4,014,000**

Bristol CAZ context:

- **Bristol's total population is around 0.5 million, though not all of these citizens live within the LEZ itself, which covers around 4 square kilometres of the city centre.**
- **The city estimated that there are 3,065 businesses inside the LEZ, of which 2,210 are micro businesses with fewer than 10 employees.**
- **The city received 11,000 applications for its vehicle replacement scheme. It progressed around 3,500 applications, of which 50% have proceeded to upgrade their vehicle.**

Key takeaways:

- **The monetised benefits of a proposed scheme should be compared to forecast costs, to determine whether it represents good value for money.**
- **The two main cost elements are implementation costs and costs to drivers in response to the scheme.**
- **Municipalities can offset these costs via revenues from drivers paying to use a non-compliant vehicle in the zone.**

4.5 Business case

UK cities must prepare a business case before introducing a LEZ. This draws on the modelling and cost-benefit analysis described above, as well as consideration of the practical aspects of setting up and managing a scheme. UK government guidance sets out how a business case should be prepared, covering five elements as described below together with suggested assessment criteria.

The Strategic Case. Sets out the case for change and the objectives of the scheme. Criteria include:

- Achieving compliance with air quality limit values in the LEZ, and in areas of the city outside the LEZ, in the shortest possible time.
- Providing equity for all members of society.

The Economic Case. Assesses shortlisted options to determine value for money. Criteria include:

- Mitigating adverse impacts on low income households.
- Improving overall public health in the city.
- Costs to citizens in response to the scheme.

The Commercial Case. Establishes the preferred procurement route, based on supplier capability and likely delivery solution. Criteria may include:

- Timescale for delivery and risks associated with procurement.

The Financial Case. Details the setup and ongoing costs of the scheme, and identifies potential funding sources. Criteria may include:

- Estimate of capital and ongoing operating costs.
- The extent to which forecast revenue will cover implementation costs.
- Risk of financial loss to the city if revenues do not cover costs.

The Management Case. Sets out the governance arrangements for the scheme. Criteria include:

- Timescales for implementing governance arrangements.
- Public and political acceptability.

Key takeaways:

- **City authorities should prepare a business case for the introduction of a LEZ, covering costs and benefits, and practical implementation aspects.**
- **Guidance in the UK for business cases covers five elements or cases: Strategic, Economic, Commercial, Financial, and Management.**

4.6 Impacts on businesses

An impact assessment should consider potential impacts on businesses, and what action they might take in response.

In the UK, most LEZs primarily impact businesses as the vehicles in scope are buses, coaches, heavy goods vehicles, and taxis. Even for schemes that also include private cars, consideration should be given to the potential impacts on businesses and how they might respond to the scheme.

Businesses that will be most affected are those which currently operate vehicles which won't comply with proposed emissions standards, and which frequently use those vehicles in the zone. Affected businesses will face costs, either to upgrade vehicles, reallocate vehicles elsewhere, switch mode, or avoid travel. In response to these costs, businesses could:

- **Absorb costs**, effectively reducing profit margins.
- **Raise prices**, effectively passing costs on to customers. This may occur indirectly, with haulage companies passing on costs to their business clients, which in turn raise prices charged to customers.

Larger businesses will typically be more able to absorb costs, so **cities should focus efforts on mitigating impacts on small businesses and sole traders.**

There is limited information from the UK on the types of businesses that will be most affected. A study by Transport for London before the launch of the LEZ found that the sectors likely to be most impacted were transport and storage, construction, and commuter services. This is because these are highly competitive markets, and as such businesses may find it harder to absorb costs or pass costs on to customers.

Key takeaways:

- **Businesses, particularly small businesses, will be impacted by the introduction of a LEZ.**
- **In response, organisations could absorb costs, or raise prices and pass costs on to their customers.**

4.7 Impacts on citizens

An impact assessment should consider potential impacts on citizens, and what action they might take in response. The citizens' impact assessment should consider benefits as well as costs associated with the scheme.

Benefits

Improved air quality will bring health benefits to citizens living in, and potentially close to, a LEZ. These benefits will not be distributed evenly.

- In many UK cities there is a correlation in inner urban areas between household income levels and pollution, with the poorest members of society often living in areas with poor quality. As such, the introduction of a LEZ could bring greater benefits to lower income households.
- The health impacts of poor air quality are greater for older people, who are more likely to have a pre-existing condition such as heart disease or asthma. Again, a LEZ could therefore bring additional benefits to this demographic group.

Costs

The costs associated with a LEZ, particularly for individuals acting in response to a scheme, may also not be equally distributed.

- As noted above, residents living in inner city areas which may be in scope of a LEZ often have lower than average household incomes, are likely to travel within the zone frequently, and are more likely to have older (and therefore non-compliant) vehicles than more affluent residents.
- These citizens are therefore more likely to need to act (by upgrading to a compliant vehicle or switching mode) and least able to pay to take such action.

Consideration should be given to mitigating financial impacts on low income households inside the zone. This could include discounts, exemptions, or a sunset period as described earlier in this toolkit; or support with vehicle replacement as set out in the next section.

Bristol undertook spatial analysis to investigate the likely impact of the LEZ on low income households. They found that:

- **Public transport, walking, and cycling could offer alternatives to driving for journeys from low income areas into the city centre.**
- **For some citizens, they will be unable to switch mode (for example due to mobility issues) and therefore will be directly affected by the cost of responding to the LEZ.**

Key takeaways:

- **An impact assessment should consider potential costs and benefits for citizens, and what action they might take in response.**
- **Benefits may not be distributed equally, and may be larger for low income households and the elderly.**
- **Costs may also not be distributed equally, and may unfairly impact low income households living in the LEZ and who frequently drive in the zone. Consideration should be given to mitigating financial impacts on these households.**

4.8 Vehicle replacement scheme

A vehicle replacement scheme – sometimes called vehicle scrappage – could be introduced to mitigate financial impacts on low income households, small businesses, and sole traders. Schemes typically provide grants or loans to help meet the cost of replacing vehicles that don't meet LEZ standards.

The scheme will need funding to cover grants and loans, including the risk of default in the latter case. There will also be costs for promoting and administering the scheme.

Eligibility criteria should be set to ensure support is targeted where it is most needed. For example, the scheme could focus on low income citizens, disabled drivers, charities, sole traders, and small businesses. It could be restricted only to citizens and organisations based inside the zone, or extended to cover areas outside the zone as well.

A proposed vehicle replacement scheme must be assessed to ensure it meets three criteria:

- **Economic:** the extent to which it boosts the local and domestic economy.
- **Environmental:** the emissions benefits of accelerating the replacement of older vehicles with newer, cleaner alternatives.
- **Social:** ensure the scheme is targeted to potentially vulnerable groups.

Bristol made £14m to fund a vehicle replacement scheme. It received 11,000 applications, and around 1,750 applicants have received funding and upgraded a vehicle.

The Mayor of London provided at least £60 million for a scrappage scheme to support small businesses, charities, citizens on low incomes and disabled citizens. The grants available are shown in the table below, together with the number of vehicles scrapped.

Vehicle type	Grant level	Vehicles replaced
Cars	£2,000	9,660
Motorcycles	£1,000	52
Vans and minibuses	£6,000 to £11,500	5,200

Schemes do not have to provide support with replacing a non-compliant vehicle with a newer vehicle. Instead, **support could be provided in the form of credits to use on public transport or other mobility services such as e-bikes and car clubs.**

Financial support schemes should ideally be launched up to two years before the LEZ starts, to give people time to apply, receive funding, and take action.

Bristol aimed to help citizens reduce car journeys with free cycling trials, eScooter credit and bus taster tickets. The council provided travel vouchers worth £100 to support access to public transport or shared mobility services. Vouchers could be used for:

- **One month bike and e-bike trials.**
- **Adult cycle training to build your confidence.**
- **Taster bus tickets.**
- **Taster train tickets.**
- **Car club credits.**

The city has so far issued 25,000 vouchers, with costs covered by revenues from the LEZ.

Key takeaways:

- **A vehicle replacement scheme could mitigate financial impacts on low income households, small businesses, and sole traders.**
- **Schemes should be designed with appropriate eligibility criteria, and ensuring they meet economic, environmental, and social objectives.**
- **Schemes could provide support with acquiring a LEZ-compliant vehicle, or support to access other modes of transport.**

5. Conclusion

LEZs are designed to improve air quality and health outcomes by reducing the public's exposure to air pollution. The UK government's advice is that LEZs with a charge for non-compliant vehicles will achieve statutory limit values in the shortest possible time.

LEZs should remove the most polluting vehicles, target areas where pollution is worst and the risk to public health is highest, and be ambitious by reflecting the best environmental performance. Although the focus is on removing polluting vehicles, LEZs are also a springboard for accelerating the transition to EVs, and implementing measures to mitigate other sources of pollution.

The information provided in this Toolkit Part 1 can be used by city authorities to develop proposals for inclusive and effective LEZs. Guidance has been provided on setting the high level strategy, designing the operational parameters for the scheme, engaging citizens and businesses, and on justifying the costs associated with a LEZ. Cities should also refer to Part 2, which contains more detail on implementation, including overcoming potential barriers specific to each study city.

Additional Resources

- **UK:** Central government publications on CAZs, including the CAZ Framework and supplementary guidance[2] and central government's CAZ economic assessment[3].
- **UK:** Central government repository for guidance on transport emissions and social factors analysis[4]. Documents linked from that page provide guidance on economic, social, and environmental impact assessments. The factors themselves are in the TAG Data Book[5].
- **London**: Overview of the ULEZ[6] and detailed supplementary documents for the ULEZ including impact assessments and consultations[7].
- **Bristol**: Overview of the CAZ[8] and outline business case[9].
- **Oxford**: Overview of the ZEZ[10] and feasibility study[11].

---

2 https://www.gov.uk/government/publications/air-quality-clean-air-zone-framework-for-england
3 https://consult.defra.gov.uk/airquality/implementation-of-cazs/supporting_documents/161012%20%20CAZ%20Impact%20Assessment%20%20FINAL%20consultation.pdf
4 https://www.gov.uk/guidance/transport-analysis-guidance-tag
5 https://www.gov.uk/government/publications/tag-data-book
6 https://tfl.gov.uk/modes/driving/ultra-low-emission-zone/ulez-where-and-when
7 https://haveyoursay.tfl.gov.uk/cleanair/widgets/44946/documents
8 https://www.bristol.gov.uk/residents/streets-travel/bristols-caz
9 https://democracy.bristol.gov.uk/documents/s32874/OBC-5%20%20BCC%20CAZ%20OBC%20Economic%20case%20310119.pdf
10 https://www.oxford.gov.uk/zez
11 https://www.oxford.gov.uk/downloads/file/4019/zero_emission_zone_feasibility_study_october_2017

Part II

Roadmap for Implementation in Chennai

Table of Contents

1. Summary 3
2. Introduction 6
3. India Policy and Economic Context 8
4. Introduction to Chennai 9
5. Citizen Engagement 10
6. Chennai: Implementation Action Plan 12
7. Workshop Summary 17
8. Conclusion 19

1. Summary

Introduction

This toolkit has been commissioned by the UK government via the UK Partnering for Accelerated Climate Transitions (UK PACT) programme. It has been developed by Cenex, a UK-based not-for-profit specialising in decarbonising transport and energy systems.

This project provides guidance on the introduction of low emission zones (LEZ). A LEZ is an area in which use of more polluting vehicles are restricted using vehicle emission standards and charges levied on non-compliant vehicles.

Rationale for Intervention

Poor air quality has negative health impacts which can be monetised to estimate the social damage being done. Implementing a LEZ is usually the most cost effective and efficient way to reduce emissions from the most polluting vehicles in areas of high population density. Zones should focus on removing the oldest most polluting vehicles from areas where pollution is worst and the risk to public health is most significant.

Benefits

The primary objective of a LEZ should be to bring down ambient pollution concentrations to improve public health and deliver compliance with legal limit values. LEZs may also help cut greenhouse gas emissions which contribute to climate change, and reduce traffic congestion.

Alignment with Current Activity

The recommendations in this strategy align with current activity in Chennai including:

- The need to tackle emissions associated with rapid expansion of the city.
- The development of the forthcoming climate change strategy.
- State-wide activity to scale up use of electric buses.

Planning and Design Summary

Aspects of planning and design to consider include:

- **Legal framework:** cities must ensure there is a legal basis for the design and implementation of a LEZ.
- **Vehicle types:** zones can include heavy and/or light duty vehicles, powered two- and three-wheelers, buses, taxis, private cars.
- **Types of zone and standards:** zones could be voluntary, an outright ban, or work on a charge paying basis. The latter is typically the best option.

- **Spatial coverage:** Zone boundaries should balance ambition and acceptance. More stringent standards (such as a ZEZ) should be piloted in a small area to test compliance and citizen acceptance.
- **Hours of operation:** LEZs could be operational 24 hours a day, or for a limited time-bound period each day.
- **Levels of charge:** Cities should set fees at a high enough level to encourage behaviour change, without unfairly impacting people on lower incomes.
- **Exemptions and discounts:** Exemptions should ensure the scheme is fair and equitable, while avoiding negating the overall benefits of the zone.
- **Vehicle detection and enforcement:** Cities will need a mechanism for detecting vehicles entering or driving in the zone, and for checking compliance and/or payment of a daily charge.
- **Impacts on citizens and businesses:** the cost for compliance with a LEZ (through upgrading a vehicle or paying a daily charge) must be considered, in particular for low income households and small businesses.

Summary Action Plan for Chennai

Refer to Section 6 for the full Implementation Action Plan. The LEZ strategy should be implemented in two phases. Short term actions are required to introduce and promote cleaner and more sustainable transport choices as the cities sustainable and shared travel options are developed further. Longer term actions involve preparing for the implementation of a charging LEZ once there are efficient and reliable alternative transport options for citizens and a more determined approach can be implemented to encourage citizens to change to cleaner transport options. The plan is summarised below.

Short-term actions

Cenex proposes the following actions to be led by Chennai municipality to start improving air quality:

- **Set up Low Traffic Neighbourhoods** as a lighter-touch measure to mitigate the negative impacts of road transport.
- **Promote sustainable travel**. Encourage a shift to active travel and other forms of sustainable travel.
- **Improve traffic management** to reduce emissions by smoothing traffic flow.
- **Reduce emissions from construction machinery** by engaging with local businesses and encouraging them to deploy newer, cleaner equipment in the zone.
- **Mitigate impacts of other emissions sources** such as field burning and road dust.
- **Improve roadside air quality monitoring** to identify localised air quality issues and apportionment.

Longer-term recommendations

1. **Set clear objectives for the zone:** demonstrate how the zone addresses a defined pollution problem in the area, and how it will improve local air quality.
2. **Improve data on areas of poor air quality** by expanding the existing network of monitoring stations and analysing outputs in conjunction with traffic flow data.
3. **Embed the LEZ in local strategies** including updates to existing documents and future reports.
4. **Develop initial proposals** using the Planning and Design summary (above) and detailed guidance in Part 1 of the toolkit as a guide. Focus on defining the spatial coverage and vehicle types in scope; and setting operating hours, potentially in line with existing heavy goods vehicle restrictions.
5. **Secure support from municipality departments** such as the transport department, pollution control board, and municipality fleet operational teams.
6. **Implement a citizen engagement strategy** focusing on how the city is improving air quality.
7. **Engage with other cities** which are designing similar LEZs. Collaboration cities allows the sharing of best practice, and can cut costs through joint procurement.
8. **Demonstrate municipality leadership:** continue to lead by example in reducing emissions from the vehicles, including the ongoing deployment of electric buses.

Workshop Learnings

Cenex held a training workshop in Chennai with city officials and a range of stakeholders with specialist knowledge across the city's transport system. Key items highlighted in the workshop were as follows:

- **LEZ activity would need to be phased** in to allow a fair and just approach ensuring citizens had viable alternative transport options.
- **Short terms** priorities should be **improving public transport** and last/first mile connectivity. LEZs should form part a long-term strategy. The current focus is on increasing access to public transport and planning integrated transport solutions for the city. Current activity on non-charging zones such as low emission zones around schools and car free Sundays can be monitored and built on.
- **Longer term** win would be to introduce LEZs once alternative transport modes are efficient and reliable. This would **encourage businesses and citizen** to use them.
- It will be important to consider the impact on citizens and businesses before any decisions are made.

Particulate matter is the key pollutant and majority of this is caused through road dust, therefore an **evidence base for impacts of road transport emissions needs to be built** through improved monitoring.

2. Introduction

Several states and cities in India have committed to measures that lower transport emissions in their cities, including trialling low emission zones (LEZ). However, there are no clear guidelines that outline best practice for achieving these measures which states and cities can tailor to their own contexts.

The UK has responded to challenges around urban air quality by introducing zones in several cities which aim to reduce the use of older more polluting vehicles. As a leader in the deployment of air quality improvement zones, learnings from UK cities' experience can be used to develop best practice guidance for other countries. This can help other jurisdictions develop and deploy their own air quality improvement zones.

This document is part of a toolkit which has been commissioned by the UK government via the UK Partnering for Accelerated Climate Transitions (UK PACT) programme. It has been developed by Cenex, a UK-based not-for-profit specialising in decarbonising transport and energy systems. For more details on the work please download Part 1 of this toolkit which contains:

- **Introduction:** including an overview of different types of zones and the UK's policy context.
- **Strategy for LEZs**: rationale for intervention and high level zone parameters.
- **Adding the detail**: in-depth operational and design guidance.
- **Justification and impact assessments**: evaluating how LEZs affect citizens and businesses.

This document – Part 2 of the toolkit – provides guidance to cities in India on the creation of LEZ to improve local air quality. Together with Part 1, it outlines what cities should consider in a strategy for LEZ development.

The roadmap is primarily intended to be used by city and state authorities in Chennai. The guidance provided here should be used in conjunction with an understanding of the local context, and city-level data, to design appropriate and inclusive LEZ.

The roadmap focuses on LEZs which are designed to improve air quality, rather than contribute to net zero targets on greenhouse gas emissions. This is in line with UK best practice on LEZ implementation. Zones which mandate the use of electric vehicles (EV) will be expensive for all citizens to comply with in the short-term and as such their implementation is unlikely to be feasible.

The structure of the remainder of this document is as follows:

- Indian national policy context on emissions reduction.
- Introduction to Chennai.

- Planning and Design: summary of best practice guidance tailored from the UK’s experience.
- Citizen Engagement: how to secure support for a LEZ.
- Chennai Action Plan, with short-term actions to improve air quality and longer-term recommendations to support the development of a LEZ strategy.

3. India Policy and Economic Context

This section sets out the national context in which cities are aiming to develop LEZs.

Net Zero Target

India aims to reach net zero greenhouse gas emissions by 2070 to reduce its contribution to climate change. LEZs should primarily be designed to tackle poor air quality by removing the oldest most polluting vehicles from the road. This is achieved in part by encouraging people to switch to newer vehicles. Newer vehicles are on average more fuel efficient than older vehicles and therefore will have slightly lower greenhouse gas emissions. As such, LEZs may have a marginal benefit in relation to climate change targets.

Some citizens and businesses will use the opportunity of purchasing new vehicles to switch to electric vehicles (EV). These have significantly lower life cycle greenhouse gas emissions than petrol or diesel vehicles, even accounting for the emissions associated with vehicle manufacture and electricity generation (when combined with a low carbon electricity supply).

Air Quality Target

The Government of India launched the National Clean Air Programme (NCAP) in 2019. NCAP is India's flagship program for better air quality in 124 cities. It aims to tackle cities' air pollution challenges with a strategy to achieve a 20-30% reduction in Particulate Matter (PM) ambient concentrations by 2024, compared to a 2017 baseline.

Air Quality Measures for Transport

Transport is a major contributor to poor air quality. India has implemented national emissions regulations to ensure newer vehicles are less polluting than older models.

Since 2000, India has adopted European level emission standards for four-wheeled light-duty and for heavy-duty vehicles. India's own regulations still apply to two- and three-wheeled powered vehicles. The primary legislative context for the latest standards is *Auto Fuel Vision and Policy 2025, produced on behalf of* the Indian Planning Commission. The Bharat emissions standards progressively tighten regulations on tailpipe pollutant emissions from new vehicles, including:

- 2010: Introduction of Bharat IV standards in selected cities.
- 2020: Introduction of Bharat VI standards (modelled on Euro 6 regulations) nationwide.

Indian Automotive Sector

The Indian automotive sector is the fifth largest globally, and could be the third largest by 2030. The sector accounts for 7 per cent of national gross domestic product (GDP) and 49% of national manufacturing GDP. LEZs and other measures which encourage the purchase of newer vehicles could deliver significant economic benefits for India's domestic automotive manufacturers.

4. Introduction to Chennai

Overview

Chennai is India's fourth largest city, with a population of around 9 million. The city is expanding rapidly, with some peripheral areas seeing annual population increases of around 50%. This expansion plus increasing affluence are leading to rapid increases in transport demand including private car ownership. Chennai is an industrial city, with pollution from industries particularly noted as part of the city's clean air plan.

Net Zero

Tamil Nadu aims to be reach net zero greenhouse gas emissions ahead of the national 2070 target, though it hasn't set a specific goal year. It has set up a climate change mission to plan a net zero strategy.

Air quality

Cities in India that did not meet Air Quality Standards between 2011 and 2015 are called Non-Attainment cities. Chennai was classed as a non-attainment city. According to the National Air Quality Index, air quality is 'Satisfactory' in most areas, though there are concerns around NO_2 concentrations at some monitoring stations. The city has targets for NO_2 and Respirable Suspended Particulate Matter (RSPM) to be lower than 40 and 60 $\mu g/m^3$, respectively.

Sources of pollution are road dust, vehicle emissions, construction activities and industrial pollution. The city has implemented actions across all sectors, including deployment of vehicles for mechanical road sweeping, monitoring air quality, use of EVs for solid waste collection, issuing directives for reducing industrial emissions, and regular checking of vehicle emissions supported by PUC certificates.

Cleaner Vehicle Policies

Tamil Nadu aims to increase the share of electric buses to 30% of the fleet by 2030. The state offers purchase incentives for all EVs, including e-bikes, electric cars, and electric buses. It is also aiming to attract investment for in EV manufacturing.

5. Citizen Engagement

Introduction

This section provides outline guidance for a citizen engagement strategy. All cities identified this as a key consideration for implementing a LEZ. Where appropriate, further tailored guidance is provided in the subsequent Action Plan section.

Citizen acceptance is crucial to the successful implementation and operation of a LEZ. The experience from the UK is that citizens are more likely to engage with, and support, initiatives if they have first-hand experience of the problem being addressed, and if action to address it is highly visible. Cities should ensure citizens understand the importance of good air quality, are aware that a LEZ is being developed, understand the choices available to them, and the impacts of these choices.

Planning

An engagement campaign should be underpinned by an impact assessment (IA), to understand how the proposed LEZ will impact different socio-economic and demographic groups. Guidance on undertaking an IA is provided in Part 1 of this toolkit. Following the IA, measures should be designed to mitigate impacts on vulnerable groups, or those who will be most affected by the scheme. For example, a mobility credits package targeted at low income households in and around the LEZ. The engagement campaign can then focus on the benefits of the scheme as well as how a fair and equitable distribution of costs will be achieved.

Consultation

Consultation should be undertaken on initial scheme proposals, with the aim of understanding:

- Citizens' knowledge of and attitudes towards air quality and pollution.
- How many vehicles are likely to be non-compliant, and what citizens would do in response to the LEZ.
- The scale of discounts and exemptions likely to be needed.
- Potential acceptance of different charges for non-compliant vehicles.

The consultation process should use as many channels as possible to maximise the number of responses, and ensure it reaches a wide range of demographic groups. Issues to consider include digital connectivity, language, and targeting people at risk of being marginalised or excluded from the process.

Responses should be analysed and the design of the scheme adjusted as necessary if there is significant opposition to certain aspects. Demonstrating that citizens' feedback was used to shape the final scheme design will help with implementation and securing support.

Themes for Engagement

There are four key themes that should be the focus of a citizen engagement campaign as shown in the table below.

Theme	Suggested Content
Health impacts	Citizens may not support a scheme purely for environmental reasons, particularly where they are paying a price in the short-term, while the benefits are realised in the long-term, or at a global scale. Messaging should focus on the health impacts of pollution and the benefits to citizens of improving air quality.
Practical aspects	Ensure it is easy for citizens to find information about the LEZ and deal with the administrative aspects. Set up a website with a map of the zone, information on emissions standards, a service to check and pay a charge, functionality to set up an account and save vehicle and payment details, information on exemptions and discounts, refunds and complaints procedures, and signposting to other support (e.g., retrofit, EV grants, travel advice and mode shift options).
Progress	Regularly share information with citizens on improvements to air quality and associated health benefits. Updates should be published monthly if possible.
Related activities	Explain what else the city is doing to reduce emissions, e.g., where it is leading by example in cleaning up its own fleet or investing in measures to support the transition to EVs.

Channels

Engagement activity campaigns should leverage social, local, and other media to engage different citizen groups. When selecting campaign channels, consider the need to reach citizens who may live outside the planned LEZ area. Innovative campaign channels might include:

- 'Clean Air' days, encouraging people to use sustainable transport or active travel.
- Education activities in schools, community groups, health centres and doctors' surgeries.
- Engagement via stakeholders including political representatives and organisations, other cities and neighbouring states, charities, businesses, transport and road user groups, and health and environmental community organisations.

6. Chennai: Implementation Action Plan

Introduction

This section provides a high-level tailored action plan for Chennai based on information supplied by the city and discussions between Cenex and city representatives, including at the training workshop.

Objectives

Chennai seeks to implement a LEZ to reduce transport emissions. It has requested guidance on:

- Estimating costs and economic modelling of impacts.
- A methodology for LEZ planning, including zoning.
- Embedding activity into long-term sustainability planning.

These are all covered in depth in Part 1 of this toolkit. This section provides additional guidance appropriate to Chennai.

The LEZ strategy should be implemented in two phases. **Short term** actions are required to introduce and promote cleaner and more sustainable transport choices as the cities sustainable and shared travel options are developed further. **Longer term** actions are to review the implementation of a charging LEZ once there are efficient and reliable alternative transport options for citizens and a more determined approach can be implemented to encourage citizens to change to cleaner transport options.

Short-Term Actions to Improve Air Quality

Cenex proposes the following actions to be led by Chennai municipality to start improving air quality:

- **Set up Low Traffic Neighbourhoods**. If a city can't commit to introducing a LEZ, or a LEZ is not required to improve air quality, a low traffic neighbourhood (LTN) could be introduced as a lighter-touch measure to mitigate the negative impacts of road transport. Detailed guidance on LTNs is in Part 1 of this Toolkit.
- **Improve the availability of sustainable options.** Work on improvements of the quality and availability of public transport, promotion of EV charging stations, awareness of low emission policies, promotion of public transport and non-motorised transport options.
- **Promote sustainable travel**. Encouraging a shift to active travel and other forms of sustainable travel. Measures can include:
    - School travel planning to encourage walking, cycling, and use of public transport.
    - Communications activity around the health benefits of active travel and air quality.

  - Working with business, communities and schools to encourage the provision of cycle racks and changing facilities.
  - Creating safe, continuous and convenient cycling and walking networks.
- **Improve traffic management**. Improving traffic management in a LEZ can reduce emissions by reducing traffic and smoothing traffic flow, improving journey time reliability, and encouraging more active travel. Measures can include:
  - Improving road layouts and junctions to improve traffic flow.
  - Bus priority schemes to improve reliability and journey times.
  - Public realm improvements to make streets are attractive for active travel.
  - Optimising traffic signal operation to reduce unnecessary traffic.
  - Using real-time information to inform travellers of their choices and manage demand.
- **Reduce emissions from construction machinery.** Emissions from construction machinery can be a significant source of air pollution. Engines can emit significant pollutants, depending on their age, power rating, and intensity of utilisation. Assess the contribution to pollution of emissions from construction machinery. If modelling shows that impacts are significant, the city should engage with local businesses and encourage them to deploy newer, cleaner equipment in the zone.
- **Mitigate impacts of other emissions sources.** Emissions from field burning of agricultural crop residue is a common environmental hazard. Cities can mitigate the impact of this by using vegetation to block flows of pollution into urban areas, as well as by using sprinklers and sweeping. Road dust can be reduced by maintaining roads and repairing potholes; greening open areas, gardens, community places, schools and housing associations; and blacktopping road surfaces including pavements and road shoulders.
- **Improve roadside air quality monitoring**. Harmful air quality emissions from vehicles can be very localised to time of day, junction and city design. To ensure that air quality emissions are at a safer limit across the city it is recommended that localised air quality mapping and modelling is undertaken. This can advise on local hot spots and focus air quality interventions.

Longer-Term Recommendations to Develop a LEZ

Cenex proposes the following actions to be led by Chennai municipality:

1 <u>Set clear objectives for the zone.</u>

The city will need to demonstrate how the LEZ addresses a defined pollution problem in the area, and how it will improve local air quality. A LEZ should support the city to work towards the World

Health Organisation's Guidelines for air quality concentrations[1]. Any planned LEZ should include a review to ensure there is a robust supportive legal framework in place.

2 Improve data on areas of poor air quality

Currently Chennai only has a small number of operational air quality monitoring stations; only three stations which are controlled by the Central Pollution Control Board (CPCB) and a further five which have yet to become fully operational. This network should be expanded so that the municipality has access to good data to identify current zones of high and low pollution.

Air quality monitoring data will need to be overlayed with traffic flow data – either from sensors or manual traffic counts – to correlate areas of poor air quality and high levels of traffic. Without this second step, zones could be implemented in areas where pollution is caused by non-transport sources.

3 Embed the LEZ in local strategies

The LEZ should be embedded in relevant city- and state-level strategies, plans and policies. Ideally it should be covered in the forthcoming *Chennai Mobility Plan*, as well as other future decarbonisation, transport or energy strategies.

Alongside production of the mobility plan, Chennai is developing software to model citizens' travel behaviour, including potential responses to changes to the transport system. It is important that this software can model the impact of a potential LEZ. This should include citizens' potential responses to the zone (upgrading vehicles, paying charges, taking alternative routes, using alternative modes, or not travelling) and the likely costs to citizens of these responses.

4 Develop initial proposals

Develop proposals for a LEZ using the information in Part 1 of the toolkit as a guide. Key areas for Chennai to focus on are:

- Defining spatial coverage for a LEZ area. Spatial coverage should be determined primarily through analysis of pollution levels and traffic flows as described above. Chennai should also consider the characteristics of residents and businesses inside the proposed area, their current vehicle ownership and use patterns, and the number of entry/exit points that will be in scope. Data sources may include vehicle registration databases, remote sensing device (RSD) data, and roadside traffic counts. Finally, consideration should be given to Chennai's

[1] WHO Air Quality Guidelines (c40knowledgehub.org)

land-use zoning regulations as this will provide insights into the types of citizens and/or organisations which are likely to be impacted by a LEZ.

- Define the vehicle types in scope. To determine which vehicles should be affected by a LEZ, improved data is needed on the relative contribution of each vehicle type. Other cities are increasingly using remote sensing devices (RSD) on the roadside to monitor real driving emissions. RSD can measure emissions instantaneously from passing vehicles, and analysis can then benchmark the performance of different vehicles and identify the worst emitters. Using this data, vehicle standards for the zone can be set. For example, the zone could levy a charge on vehicles not matching Bharat 4 or Bharat 6 standards or place an outright ban or charge for entering the zone on vehicles over a certain age or not meeting a certain emissions standard.

- Set operating hours. Chennai already restricts entry of heavy vehicles into the city between 6am and 10am, and 4pm to 10pm. Avoid having multiple time-based restrictions for different schemes to avoid unnecessary complexity for drivers.

- Set an enforcement strategy. If an RSD network is installed to support scheme design, this could also be used for enforcement. Alternatively a network of ANPR cameras and back office system may be required; in which case quotes should be obtained for the set up and ongoing operation of this solution.

5 <u>Secure support from municipality departments</u>

Multiple departments will have interest in, or potentially influence over, the design and implementation of the LEZ. Early engagement will help secure buy-in and ensure potential issues are identified early. Departments and their likely areas of interest or responsibilities are as follows:

- **Environmental or Sustainability:** setting up air quality monitoring stations, analysing data, and reporting on pollution concentrations.
- **Strategic Planning or City Planning:** designing the LEZ and setting the parameters as outlined in Parts 1 and 2 of this toolkit. Commissioning business case analysis and producing the justification for the scheme.
- **Highways:** installing infrastructure such as cameras and signage.
- **Finance:** supporting with the administrative side of running the scheme including managing payments.
- **Communications:** leading on business and citizen engagement.
- **Pollution Control Board:** supporting design of the LEZ to maximise benefits and complement other activities.
- **Municipality fleet management:** ensuring the city's own vehicles are LEZ-compliant as early as possible.

A cross-departmental working group may be required to coordinate these strands of activity.

6 Implement a citizen engagement strategy

There is a risk that a charging-based LEZ will be unpopular with citizens, whose priorities are economic development and income. The guidance provided in this document and Part 1 of the toolkit should be used to design an effective citizen engagement strategy, focusing on health benefits, and the measures provided by the city to mitigate the impact of the scheme on lower income households.

Chennai is currently surveying citizens as part of the development of the Comprehensive Mobility Plan. The survey is focused on public transport and road safety. This survey should be expanded to cover views on air pollution and control measures, or another survey should be launched when the current version closes.

7 Engage with other cities

Chennai should engage with other cities in India which are designing similar LEZs. Collaboration between cities allows the sharing of best practice, and can cut costs through joint procurement of relevant hardware, software, and services.

8 Demonstrate municipality leadership

The municipality should continue to lead by example in reducing emissions from the vehicles it controls directly or can influence. This includes supporting the transition to EVs of buses and other vehicles controlled by the municipality.

7. Workshop Summary

Cenex held a training workshop in Chennai with city officials and a range of stakeholders with specialist knowledge across the city's transport system. The workshop covered 16 municipality departments with around 150 attendees. Attendees were requested to provide feedback on i) The type of LEZs that could be implemented, ii) What the short term (quick wins) and longer-term LEZ strategy could be iii) Which city strategies should include provisions and planning for a LEZ?, iv) What would be the barriers to implementation and potential solutions?, v) Are there any data and information gaps to aid with decision making?

A summary of the workshop response is below.

What type of LEZs could work in Chennai? Which area/s?

- Chennai should start with smaller zones and trials, looking at what has and hasn't worked in the past and expanding on this.
- Introducing time restrictions for vehicle types will help tackle congestion and air quality.

What could the short term (quick wins) and longer-term LEZ strategy be?

- In the short-term promotion and development of alternatives to personal transport should be undertaken. Current activity is already taking place on implementing low emission zones around schools and hospitals and introducing car free Sundays. This activity should be monitoring and expanded.
- Longer term wins would be to introduce LEZs once alternative transport modes are efficient and reliable. This would force businesses and citizen to use them.

Setting objectives - can a LEZ support and be integrated into other Chennai city strategies?

- Need tying into other strategies such as the comprehensive mobility plan and wholistic air quality reduction plans across residential and industrial emissions.
- LEZ planning needs to ensure that alternative transport options are available for citizens first, from the introduction of bus priority lanes/ metro lines to the policy for zero emission vehicles and enabling battery swapping stations for two wheelers (for example).
- There is a lack of public transport options, it is estimated that there are around 2,800 buses in the city, whereas the requirement for buses could be up to 9,000.
- There is also IBCT activity in city design and promotion of green spaces to help improve air quality.
- LEZ activity should be tied into parking policy and other measures.

What would be the barriers to implementation and potential solutions?

- Impacts on traffic and businesses business should be assessed as part of a LEZ feasibility study.

- Key issues are re-suspended particulate matter and dust. Any measure to introduce LEZs and restrict transport requires an evidence base.

Are there any data / information gaps to aid with decision making?

- Street level air quality maps are not available and a knowledge gap on how to produce and model this exists.

8. Conclusion

Chennai is a rapidly growing city and as such needs to take action to reduce air pollution.

- In the short-term promotion and development of alternatives to personal transport should be undertaken. Current activity is already taking place on implementing low emission zones around schools and hospitals and introducing car free Sundays. This activity should be monitoring and expanded.
- Longer term wins would be to introduce LEZs once alternative transport modes are efficient and reliable. This would force businesses and citizens to use them.

This strategy and supporting toolkit, based on best practice from the UK's LEZ experience, modified to encompass local considerations and knowledge will enable Chennai to move to the detailed planning and implementation stages.

Low Emission Zoning
A Toolkit for Chennai

Low Emission Zoning is a city planning strategy that tackles the rising concerns of air pollution and climate change. The aim is to improve the air quality, lower the city's carbon footprint and address climate change, and improve the overall well-being of residents.

The State Planning Commission in association with the British Deputy High Commission in Chennai, partnering with CENEX, has crafted a special toolkit for **Low Emission Zones** (LEZ) in Chennai. CENEX - a part of the UK Government's UK PACT Program - specialises in making transportation and energy systems eco-friendly.

This toolkit brings together many best practices from land use planning, transportation strategies, sustainable construction and emission reduction guidelines. This toolkit aims to help Chennai's city administration create a more sustainable and healthy future for the residents.